

# **MANUAL OF REGULATIONS AND PROCEDURES FOR FEDERAL RADIO FREQUENCY MANAGEMENT**

*January 2023 Revision of the  
January 2021 Edition*



**U.S. DEPARTMENT OF COMMERCE  
National Telecommunications and Information Administration**



## ABOUT THIS MANUAL

1. This Manual of Regulations and Procedures for Federal Radio Frequency Management (hereafter referred to as “this Manual”) is issued by the National Telecommunications and Information Administration (hereafter referred to as “NTIA”) through the Assistant Secretary of Commerce and Information (hereafter referred to as “the Assistant Secretary”) and is specifically designed to cover NTIA and the Assistant Secretary’s frequency management responsibilities pursuant to authority delegated by the National Telecommunications and Information Organization Act, as amended (47 U.S.C. 901 et seq.).

2. This Manual provides the rules, within the jurisdiction of the United States Government, for the use of the radio frequency spectrum for radio transmissions for telecommunications or for other purposes, which shall be made by United States Government stations only as authorized by the Assistant Secretary. Such use shall, unless specific provision is made otherwise, comply with the provisions of this Manual.

3. The Communications Act of 1934, as amended, vests in the Federal Communications Commission (FCC) responsibility for the regulation of non-Government interstate and foreign telecommunication, including the assignment of space in the radio frequency spectrum among private users, regulation of this use of that space, and authorization of alien amateur operators, licensed by their governments, for operation in the United States under reciprocal arrangements.

4. The Act, in recognition of the Constitutional powers of the President, provides that radio stations “belonging to and operated by the United States” shall use frequencies as determined to be in the national interest, to authorize foreign governments to construct and operate radio stations in the fixed service at the United States seat of government, and to assign frequencies thereto (47 U.S.C. 305(d)).

5. The President by Reorganization Plan No. 1 of 1977 and Executive Order 12046 of March 26, 1978, delegated to the Secretary of Commerce authority to act in the discharge of certain of the President's telecommunication functions under the Communications Act of 1934 and the Communications Satellite Act of 1962.

6. The Secretary of Commerce originally delegated this authority to the Assistant Secretary for Communications and Information (Administrator of the National Telecommunications and Information Administration (NTIA)) under Departmental Organization Order 10-10 (May 1978). This authority and delegation was later codified in the NTIA Organization Act, Pub. L. No. 102-538, 106 Stat. 3533 (1992) (codified at 47 U.S.C. 901 et seq.). The Assistant Secretary discharges these radiocommunication and frequency management functions as the Administrator of NTIA.

## Promulgation

By virtue of the authority vested in me pursuant to Reorganization Plan No. 1 of 1977, Executive Order 12046 of March 28, 1978, and Department of Commerce Organization Order 10-10 of October 5, 1992, I hereby approve this Manual of Regulations and Procedures for Federal Radio Frequency Management for the use of agencies and establishments of the Federal Government.

This order is UNCLASSIFIED.



Alan Davidson  
Assistant Secretary of Commerce for Communications and Information

Dated: 11/8/2022





**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Telecommunications and**  
**Information Administration**  
Washington, D.C. 20230

To:       HOLDERS OF THE NTIA MANUAL OF REGULATIONS AND PROCEDURES  
          FOR FEDERAL RADIO FREQUENCY MANAGEMENT

Subject:   January 2023 Revision of the January 2021 Edition of the NTIA Manual

The National Telecommunications and Information Administration has approved the January 2023 Revision of the January 2021 Edition of the NTIA Manual for use by the agencies and establishments of the Federal Government.

**Charles  
Cooper**

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# Chapter 1

## Authority and Organization

### 1.1 AUTHORITY AND FUNCTIONS DIRECTED BY THE SECRETARY

The Communications Act of 1934, as amended, provides for the regulation of interstate and foreign commerce in communication by wire or radio. This Act is printed in Title 47 of the United States (U.S.) Code, beginning with Section 151.

The functions relating to assigning frequencies to radio stations belonging to and operated by the U.S., or to classes thereof, conferred upon the President by the provisions of Section 305(a) of the Communications Act of 1934, were transferred to the Secretary of Commerce by Reorganization Plan No. 1 of 1977 and Executive Order 12046 of March 27, 1978. The National Telecommunications and Information Administration (NTIA) Organization Act, as revised, directs the Secretary to assign to the Assistant Secretary and the NTIA the responsibility for the performance of the Secretary's communications and information functions, including those above.

These functions were transferred to the Assistant Secretary of Commerce for Communications and Information (Administrator, NTIA) by Department of Commerce Organization Order (DOO) 10-10, effective date of September 28, 1992. This authority and delegation has been codified in the NTIA Organization Act, Pub. L. No. 102-538, 106 Stat. 3533 (1992) (codified at 47 U.S.C. 901 et seq.). DOO 10-10 is reproduced below.

#### ASSISTANT SECRETARY FOR COMMUNICATIONS AND INFORMATION

##### Section 1. The purpose of this order.

.01 This Order prescribes the scope of authority and functions of the Assistant Secretary for Communications and Information. (The functions of NTIA are covered in DOO 25-7.)

.02 This revision reflects the deletion of the position of Deputy Administrator for Operations and incorporates outstanding amendments to the Order.

##### Section 2. Administrative Designation.

The position of Assistant Secretary of Commerce for Communications and Information (the "Assistant Secretary") was established by Section 4 of Reorganization Plan No. 1 of 1977. The Assistant Secretary is appointed by the President by and with the advice and consent of the Senate.

##### Section 3. Scope of Authority.

.01 The National Telecommunications and Information Administration is hereby established as an operating unit of the Department of Commerce.

.02 The Assistant Secretary shall head NTIA as the Administrator.

.03 The Deputy Assistant Secretary for Communications and Information shall be the Assistant Secretary's principal policy advisor; shall perform such other functions as the Assistant Secretary shall from time to time assign or delegate; and shall act as Assistant Secretary during the absence or disability of the Assistant Secretary or in the event of a vacancy in the office of the Assistant Secretary.

##### Section 4. Transfer of Functions.

Pursuant to the authority vested in the Secretary of Commerce by Reorganization Plan No. 5 of 1950, Section 4 and 5.B of Reorganization Plan No. 1 of 1977 and Executive Order 12046 of March 27, 1978; the functions, personnel, funds, property, and records transferred to the Secretary of Commerce pursuant to Reorganization Plan No. 1 of 1977 are hereby transferred to the NTIA.

##### Section 5. Delegation of Authority.

.01 Pursuant to the authority vested in the Secretary of Commerce by law, and subject to such policies and directives as the Secretary may prescribe, the Assistant Secretary is hereby delegated the authority vested in the Secretary of Commerce under:

a. Section 5.B of Reorganization Plan No. 1 of 1977, and by Executive Order 12046; including:

1. Subsection 201(a) of the Communications Satellite Act of 1962 (47 U.S.C. 701 et seq.) as amended to advise and assist the President in connection with the functions previously conferred upon the President as described more particularly in Part B, Section 7 of Executive Order 12046.

2. Subsection 305(a) of the Communications Act of 1934 (47 U.S.C. 305(a)) to assign frequencies to, and amend, modify, and revoke frequency assignments for radio stations belonging to and operated by the United States,

subject to the disposition of appeals by the Director, Office of Management and Budget (OMB), and make frequency allocations.

3. Subsection 305(d) of the Communications Act of 1934, as amended, (47 U.S.C. 305(d)), to authorize a foreign government to construct and operate a radio station pursuant to this subsection and the assignment of a frequency for its use shall be made only upon recommendation of the Secretary of State and after consultation with the Attorney General and the Chairperson of the Federal Communications Commission.

b. 15 U.S.C. 3710a and Executive Order 12591 to transfer federal telecommunications technology by, among other things, entering into cooperative research and development agreements (CRADAs) with other federal laboratories, State and local governments, universities, and the private sector and by licensing, assigning, or waiving rights to intellectual property developed pursuant to such CRADAs or from within individual laboratories.

c. 15 U.S.C. 272(12) and (13), which relate to the investigation of the conditions which affect transmission of radio waves and to the compilation and distribution of information about such transmissions.

d. 15 U.S.C. 272(9), the functions which relate to the investigation of non-ionizing radiation, its uses, and means of protection of persons from harmful effects to the extent appropriate to coordination of research throughout the Executive Branch.

e. 47 U.S.C. sections 390-393A and 397 (contained in the Communications Act of 1934, as amended), which govern the implementation and administration of assistance for public telecommunications facilities.

f. Section 5112(b) of the Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-418) relating to telecommunications research and the publication of results.

g. 47 U.S.C. section 394 (contained in the Communications Act of 1934, as amended), which establishes the National Endowment for Children's Educational Television. (P.L. 101-437 of October 18, 1990.)

.02 The Assistant Secretary may exercise other authorities of the Secretary to the extent applicable to performing the functions assigned in this Order. This includes the use of administrative and monetary authorities contained in 15 U.S.C. 271 et seq., as may be necessary or desirable to perform the NTIA functions; and the authority to foster, promote, and develop the foreign and domestic commerce of the United States in affecting, and as such commerce may be affected by, the development and implementation of telecommunications and information systems

.03 The Assistant Secretary may redelegate any authority conferred by this Order to any employee of the NTIA and may authorize further redelegation by any such employee as appropriate, subject to such conditions as may be prescribed.

## **Section 6. General Functions and Objectives.**

The Assistant Secretary shall:

a. Serve as the President's principal advisor on telecommunications policies pertaining to the Nation's economic and technological advancement and to the regulation of the telecommunications industry.

b. Advise the Director, OMB on the development of policies for procurement and management of federal telecommunications systems.

c. Conduct studies and evaluations concerning telecommunications research and development, the initiation, improvement, expansion, testing, operation, and use of federal telecommunications systems and programs, and make recommendations concerning their scope and funding to appropriate agency officials and to the Director, OMB.

d. Actively promote the transfer of telecommunications technology developed in NTIA's laboratory and offices to state and local governments, universities, and the private sector.

e. Develop and set forth, in coordination with the Secretary of State and other interested agencies, plans, policies, and programs, which relate to international telecommunications issues, conferences, and negotiations. The Assistant Secretary shall coordinate economic, technical, operational, and related preparations, for U.S. participation in international telecommunications conferences and negotiations; provide advice and assistance to the Secretary of State with respect to international telecommunications policies to strengthen the position and serve the best interests of the United States in the conduct of foreign affairs.

f. Provide for the coordination of the telecommunications activities of the Executive Branch and assist in the formulation of policies and standards for the telecommunications activities of the Executive Branch including considerations of interoperability, privacy, security, spectrum use, and emergency readiness.

g. Develop and set forth telecommunications policies pertaining to the Nation's economic and technological advancement and the regulation of the telecommunications industry.

h. Ensure that the Executive Branch views on telecommunications matters are effectively presented to the Federal Communications Commission and, in coordination with the Director, OMB, and the Congress.

i. Assign frequencies to, and amend, modify, and revoke frequency assignments for radio stations belonging to and operated by the United States, make frequency allocations, establish policies concerning spectrum assignment

allocation and use, and provide the various departments and agencies with guidance to assure that their conduct of telecommunications activities is consistent with these policies.

j. Develop, in cooperation with the Federal Communications Commission, a comprehensive long-range plan for improved management of all electromagnetic spectrum resources, including jointly determining the National Table of Frequency Allocations.

k. Conduct studies and develop, set forth or recommend policies concerning the impact of the convergence of computer and communications technology and the emerging economic and social implications of the greater ability to originate, manipulate and move information.

l. Coordinate federal telecommunications assistance to State and local governments; conduct studies to identify and provide assistance to remove barriers to telecommunications applications; conduct needs assessments to aid in the design of telecommunications services and provide experimental and pilot tests of telecommunications applications to fulfill national goals; and provide for the application of telecommunications technologies and services to avoid waste and achieve an efficient delivery of public services in the furtherance of national goals.

m. Participate with and perform staff services for the National Security Council and the Director, Office of Science and Technology Policy in carrying out their functions under Executive Order 12046.

n. Participate in evaluating the capability of telecommunications resources in recommending remedial actions and in developing policy options.

o. Review and coordinate research into the side effects of non-ionizing electromagnetic radiation and coordinate, develop and set forth plans, policies, and programs thereof.

p. Acquire, analyze, synthesize, and disseminate data and perform research in general on the description and prediction of electromagnetic wave propagation and the conditions which affect propagation, on the nature of electromagnetic noise and interference, and on methods for the more efficient use of the electromagnetic spectrum for telecommunications purposes; and prepare and issue predictions of electromagnetic wave propagation conditions and warnings of disturbances in those conditions.

q. To the extent it is deemed necessary to continue the Interdepartment Radio Advisory Committee (IRAC) that Committee shall serve in an advisory capacity to the Assistant Secretary.

r. Perform analysis, engineering, and administrative functions, including the maintenance of necessary files and data bases, as necessary in the performance of assigned responsibilities for the management of electromagnetic spectrum.

s. Conduct research and analysis of electromagnetic propagation, radio systems characteristics, and operating techniques affecting the utilization of the electromagnetic spectrum, in coordination with specialized, related research and analysis performed by other federal agencies in their areas of responsibility.

t. Conduct research and analysis in the general field of telecommunications sciences in support of assigned functions and in support of other government agencies.

u. Conduct and coordinate economic and technical analyses of telecommunications policies, activities, and opportunities in support of assigned responsibilities.

v. Make grants, enter into cooperative agreements, or make proposals for contracts related to any aspect of assigned responsibilities, in accordance with Department rules.

w. Issue such rules and regulations as may be necessary to carry out the functions delegated by this Order.

x. Conduct such other activities as are incident to the performance of telecommunications and information functions assigned in this Order.

y. Enter CRADAs and intellectual property licenses for the transfer and/or commercialization of telecommunications technology, as needed.

z. Protect valuable telecommunications technology by obtaining legal protection for intellectual property rights associated with such technology.

## **Section 7. Effect on Other Orders.**

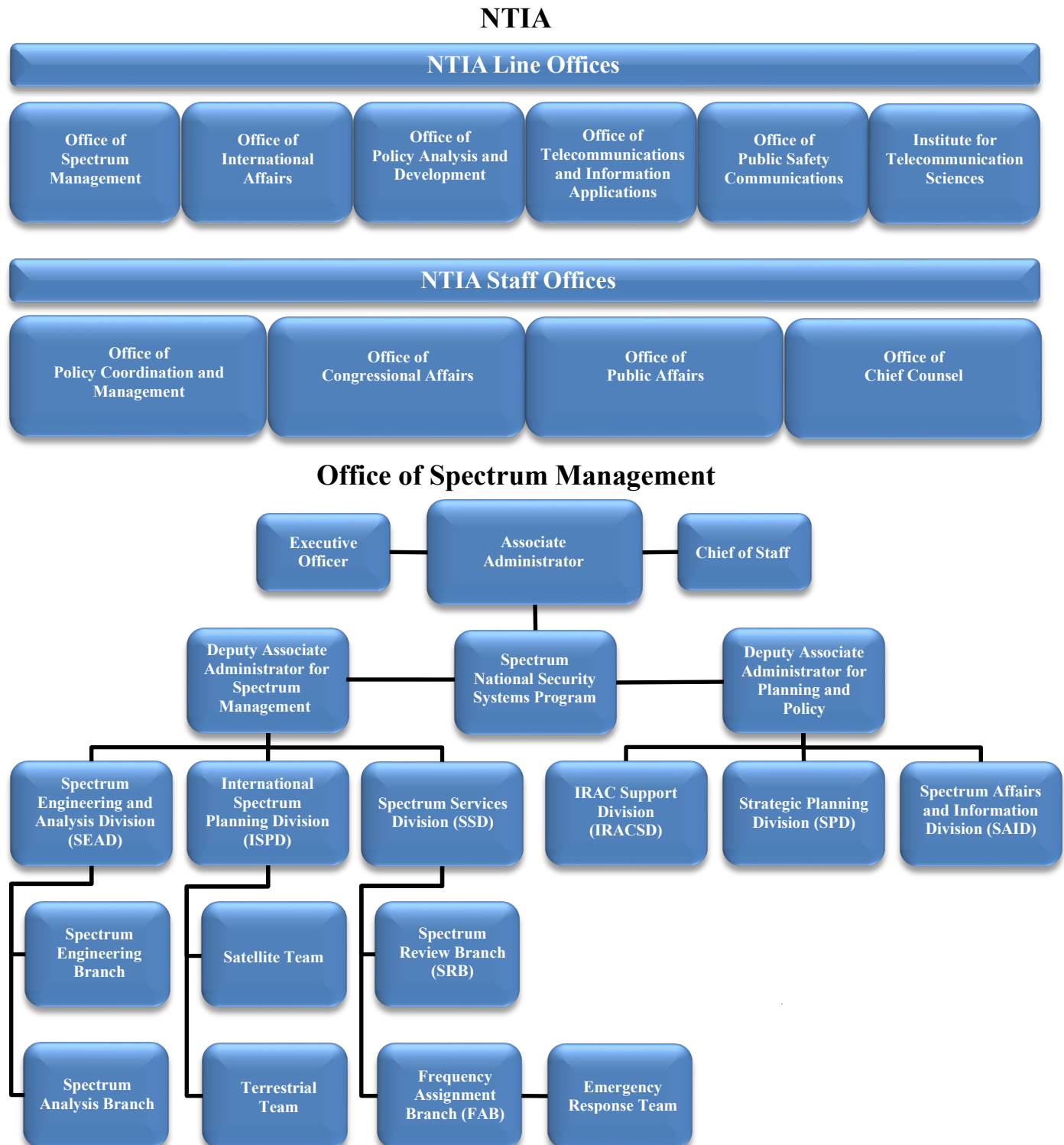
This Order supersedes Department Organization Order 10-10, dated May 9, 1978, as amended.

(signed) Secretary of Commerce

## 1.2 NTIA AND ITS FREQUENCY MANAGEMENT SUPPORT ORGANIZATION

The following charts display the organization of NTIA and its Office of Spectrum Management. Spectrum management within NTIA is under the direction of its Associate Administrator, Office of Spectrum Management. The Office of Spectrum Management among other things provides the staff for the Interdepartment Radio Advisory Committee (IRAC).

### 1.2.1 Organization Charts



## **1.3 INTERDEPARTMENT RADIO ADVISORY COMMITTEE**

### **1.3.1 Status**

The Interdepartment Radio Advisory Committee (IRAC), organized by mutual agreement of the federal departments concerned on June 1, 1922, reconstituted on October 6, 1952, with status, mission, and functions officially defined on December 10, 1964, was continued by the Assistant Secretary pursuant to Executive Order 12046 of March 27, 1978, and the National Telecommunications and Information Administration Organization Act, as revised. The IRAC serves in an advisory capacity to the Assistant Secretary and reports to the Deputy Associate Administrator, Office of Spectrum Management.

### **1.3.2 Bylaws**

#### **Article I - Name and Location**

**Section 1** - The Committee shall be known as the Interdepartment Radio Advisory Committee (IRAC).

**Section 2** - The office of the IRAC shall be at the seat of the Federal Government.

#### **Article II - Mission, Functions, and Role**

**Section 1** - The mission of the IRAC is to assist in the discharge of the Assistant Secretary's responsibilities pertaining to the use of the electromagnetic spectrum, as contained in Executive Order 12046, the National Telecommunications and Information Administration Organization Act, as revised and Department of Commerce Order 10-10.

**Section 2** - The basic functions of the IRAC are to assist the Assistant Secretary in assigning frequencies to U.S. Government radio stations and in developing and executing policies, programs, procedures, and technical criteria pertaining to the allocation, management, and use of the electromagnetic spectrum.

**Section 3** - The basic role of representatives appointed to serve on the IRAC is to function, when in Committee, in the interest of the United States as a whole.

#### **Article III - Composition**

##### **Section 1 - Membership**

a. The IRAC shall consist of the following member departments, and agencies together with such other departments and agencies as the Deputy Associate Administrator, Office of Spectrum Management may hereafter designate.

Agriculture

Air Force

Army

Coast Guard

Commerce

Energy

Federal Aviation Administration

Homeland Security

Interior

Justice

National Aeronautics and Space Administration

Navy

National Science Foundation

State

Transportation

Treasury

United States Agency for Global Media

United States Postal Service

Veterans Affairs

##### **Liaison:**

Federal Communications Commission

##### **Observers:**

Defense Information Systems Agency

Food and Drug Administration

National Security Agency

b. Any federal department or agency that uses radio frequencies shall be eligible for membership in the IRAC.

c. Address applications for membership in the IRAC to the Deputy Associate Administrator, Office of Spectrum Management via the Executive Secretary. The Deputy Associate Administrator shall review the applications and with the advice of the IRAC, determine whether to grant membership to an agency.

d. Each member of the IRAC shall have the right to appoint, via a letter to the Executive Secretary, a representative to the IRAC and to any of the subcommittees and ad hoc groups on which the member desires to participate. Each member may also appoint one or more alternates to function in the absence of its representative at the IRAC, its subcommittees or ad hoc groups. Each representative and alternate shall be an employee of the department or agency they represent, except as provided in Section 1.e of this Article.

e. Nonmember departments and agencies may designate one of the members to act as its accredited agent on the IRAC, its subcommittees, or ad hoc groups. The following nonmembers designated the IRAC member shown below to act as its accredited agent on the IRAC, its subcommittees, and ad hoc groups.

<b>Agency</b>	<b>Represented by</b>
Department of Education	Treasury
Federal Reserve System	Treasury
International Boundary and Water Commission (U.S. Section)	Interior
Pension Benefit Guaranty Corporation	Treasury
Small Business Administration	Treasury
Tennessee Valley Authority	Interior
Volpe National Transportation Systems Center	Transportation

f. Nonmember departments and agencies shall be eligible to become members of subcommittees or ad hoc groups. Requests for such membership shall be addressed to the Deputy Associate Administrator, Office of Spectrum Management via the Executive Secretary. Such requests shall explain how such departments or agencies are stakeholders and have vested interests in the products of the subcommittees or ad hoc groups on which they seek membership. The Deputy Associate Administrator shall review the applications, and with the advice of the IRAC, determine whether such applicants will be granted membership to the specific subcommittees and ad hoc groups requested. As members of specific subcommittees or ad hoc groups, these departments and agencies shall have the right to appoint, via a letter to the Executive Secretary, a representative and one or more alternates to function in the absence of its representative at those subcommittees or ad hoc groups. Each representative and alternate shall be an employee of the department or agency they represent, except as provided in Section 1.e of this Article.

g. Members of the IRAC, its subcommittees and the ad hoc groups shall ensure that their appointed representatives or alternates participate in the committees, subcommittees, and groups to which they are appointed. Any issues with a member's participation in the IRAC, subcommittee, or ad hoc group should be addressed, in the first instance, by the respective chairperson or convener as appropriate. Participation issues that cannot be resolved within a subcommittee or ad hoc group may be referred to the IRAC chairperson for resolution. The Executive Secretary shall collect and compile attendance data for the IRAC and report this information from each calendar year to the IRAC chairperson in January of each year. Subcommittee chairpersons and ad hoc group conveners shall collect, compile, and present attendance data as part of their status reports in accordance with Article XII. The IRAC chairperson will review the attendance data and may address any attendance issues as appropriate.

## **Section 2 - Liaison with the Federal Communications Commission (FCC)**

Liaison between the IRAC, its subcommittees and ad hoc groups, and the Federal Communications Commission (FCC) shall be affected by a liaison representative (within each group) appointed by the Commission to serve in that capacity.

## **Section 3 - Observers**

a. Nonmember federal departments and agencies shall be eligible for status as observers.

b. Address applications for observer status to the Deputy Associate Administrator, Office of Spectrum Management via the Executive Secretary. The Deputy Associate Administrator shall review the applications, and with the advice of the IRAC will determine whether to grant an agency observer status.

c. Each observer shall have the right to appoint, via a letter to the Executive Secretary, one or more observers for the IRAC and any of the subcommittees or ad hoc groups, which it desires to observe. Any observer may be accompanied by assistants, consultants, or advisors to any of the IRAC meetings. Each observer shall be an employee of the department or agency they represent. In this capacity, they have access to IRAC documentation. They may, at the request of the chairperson or one of the members, address the IRAC or any of its subcommittees or ad hoc groups on which they sit as observers.



## **Section 4 - Assistants, Consultants, Advisors, Visitors, and Guests**

Assistants, consultants, advisors, visitors, or guests (be they federal employees or employees of entities outside the federal government) may attend an IRAC, subcommittee or ad hoc group meeting under the sponsorship of NTIA, a member or observer department or agency, or the FCC. Sponsors must ensure that these assistants, consultants, advisors, visitors, and guests understand that information gained through IRAC attendance is used only for official government business related to the conduct of IRAC activity. Assistants, consultants, advisors, visitors and guests may speak only at the request of the Chairperson or their sponsor. If a representative or alternate of their sponsor agency is not present, they may still attend the meeting if another agency notifies the Chairperson that they will accept the responsibilities of sponsorship for that meeting. However, in these cases, those assistants, consultants, advisor, visitors, and guests may not speak on behalf of their absent sponsor.

## **Article IV - Officers**

**Section 1** – The officers of the IRAC shall consist of a Chairperson, Vice-Chairperson, Agency Vice-Chairperson, an Executive Secretary, and an Assistant Executive Secretary. The officers of subcommittees shall consist of a Chairperson, Vice-Chairperson, and a Secretary. The officers of ad hoc groups shall consist of a Convener (and, if necessary, a Vice-Convener or Co-Convener) and a Secretary.

**Section 2** – NTIA will appoint officers of the IRAC, its subcommittees and ad hoc groups, except for the Agency Vice-Chairperson.

**Section 3** – The IRAC will elect, by majority acclamation of representatives present, an accredited member as the Agency Vice-Chairperson for a term of service not to exceed 3 years and subject to re-election. The duties of the Agency Vice-Chairperson shall include the review of meeting agendas from the agencies' perspective, coordination of issues with the Chairperson, developing and presenting agency member concerns to the IRAC or NTIA, and other tasks as assigned by the IRAC. The Agency Vice-Chairperson may serve as Acting Chairperson of the IRAC in the absence of the IRAC Chairperson and Vice-Chairperson.

## **Article V - Substructure**

**Section 1** - The permanent substructure of the IRAC shall consist of the Emergency Planning Subcommittee (EPS), Frequency Assignment Subcommittee (FAS), the Radio Conference Subcommittee (RCS), the Space Systems Subcommittee (SSS), the Spectrum Planning Subcommittee (SPS), the Technical Subcommittee (TSC), and the Secretariat. As necessary to deal with specific topics, the IRAC may establish ad hoc groups operating under a written terms of reference. As necessary to deal with specific topics, subcommittees and ad hoc groups may establish working groups. Subcommittees and ad hoc groups may appoint whatever officers necessary to conduct the work of their working groups.

### **Section 2 - The Frequency Assignment Subcommittee (FAS)**

a. The FAS, chaired by NTIA, shall have as its normal function the carrying out of those functions given in Article II related to the assignment and coordination of radio frequencies and the development and execution of procedures, therefore. Only FAS representatives or alternates are authorized to submit votes for assignments on the FAS agenda or before the subcommittee.

b. In the furtherance of the above, on behalf of the IRAC and after coordination with the Deputy Associate Administrator, Office of Spectrum Management the FAS shall:

1. Address frequency assignment issues brought before the group that require discussion and resolution involving the whole membership;
2. Address, by voting on a daily basis, normal frequency assignments actions and requests for radio frequency authorizations;
3. Address problems that can not be solved by local coordination;
4. Address improvements and refinements to the frequency assignment process.

c. The FAS shall consist of a representative appointed by each of the following member departments and agencies together with such other members of the IRAC as the Deputy Associate Administrator, Office of Spectrum Management may hereafter designate.

Agriculture  
Air Force

Army  
Coast Guard

Commerce  
Energy  
Federal Aviation Administration  
Federal Communications Commission  
Homeland Security  
Interior  
Justice  
National Aeronautics and Space Administration

National Security Agency  
National Science Foundation  
Navy  
Transportation  
Treasury  
United States Agency for Global Media  
United States Postal Service  
Veterans Affairs

d. The Aeronautical Advisory Group (AAG) of the FAS, chaired by the Federal Aviation Administration (FAA), is responsible for engineering AAG frequency assignments and determining whether or not applications for frequency assignment action in the following designated bands of primary concern to the aeronautical mobile and aeronautical radionavigation services should be approved by NTIA.

190-285 kHz	978-1020 MHz inclusive
285-435 kHz <sup>1</sup>	1030 MHz
510-535 kHz	1031-1087 MHz inclusive
74.800-75.200 MHz	1090 MHz
108.000-121.9375 MHz	1104-1146 MHz inclusive
123.5875-128.8125 MHz	1157-1213 MHz inclusive
132.0125-137.000 MHz	5000-5250 MHz
328.600-335.400 MHz	

The members of the AAG shall consist of the FAA, the FCC, Air Force, Army, and Navy together with such other members of the FAS as the AAG chairperson may hereafter designate. The FAA shall designate one of its employees as the Chairperson of AAG. Any matter not unanimously agreed shall be referred to the FAS for appropriate action.

e. The Military Advisory Group (MAG), chaired by the Air Force, is established under the cognizance of the NTIA IRAC Frequency Assignment Subcommittee (FAS) to provide guidance and procedures for the management of the 225.000-328.600 and 335.400-399.900 MHz frequency bands (hereafter referred to as “*the MAG bands*”), which are of primary concern to the military departments.

1. The MAG is responsible for determining whether applications for frequency assignments in the MAG bands should be approved by the NTIA. The MAG shall provide spectrum-related guidance for the services in these bands including the development, review, and recommendations to appropriate allotment plans. The MAG shall:

- a) Recommend and provide guidance and procedures to ensure the effective and efficient operation and management of spectrum-dependent devices that access the MAG bands;
- b) Be cognizant of the operational requirements of all stakeholders in the bands, especially the unique military tactical and training requirements;
- c) Manage assignments as they relate to the allotment plan for the MAG bands;
- d) Coordinate spectrum policy guidance involving the MAG bands with the members of the applicable NTIA subcommittees and ad hoc groups;
- e) Provide minutes of all MAG meetings to the FAS Chair, the Secretary and representatives.

2. In order to facilitate coordination and access to the MAG bands, and to minimize interference among electronic systems, the FAS and the MAG shall observe established coordination procedures.

3. Meetings will be scheduled as required to successfully complete the assigned workload by established target dates.

4. The MAG shall consist of one primary and one alternate member from the U.S. Army, Navy, Air Force and the FAA together with such other members of the FAS as the MAG chairperson may hereafter designate. The Air Force shall designate one of its employees as the MAG Chair. Personnel from other Department components or federal agencies may participate in meetings, as authorized by the MAG Chair.

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<sup>1</sup> In these bands only applications for stations in the Aeronautical Radionavigations Service (See Table A, Section 6.1.4) shall be sent to the Chairman of the AAG.

5. Any matter not agreed upon may be referred to the FAS for appropriate action.

### **Section 3 - The Spectrum Planning Subcommittee (SPS)**

a. The SPS, chaired by NTIA, shall have as its primary function the review and coordination of plans by federal agencies to develop, procure, and deploy major spectrum-dependent systems with the objective of ensuring electromagnetic compatibility among new and incumbent systems. To this end, the subcommittee will develop and execute procedures governing the review process used to formulate recommendations to OSM on behalf of the IRAC concerning certification of spectrum support for federal systems. The SPS will also support the IRAC by considering changes in the manner in which federal agencies use spectrum that may necessitate modifications to the allocations and associated rules and procedures by which NTIA governs such use. In the furtherance of the above, on behalf of the IRAC and after coordination with the Deputy Associate Administrator, Office of Spectrum Management the SPS shall:

1. Recommend changes to the National Table of Frequency Allocations, as appropriate, to accommodate:
  - a) New developments in existing services;
  - b) New techniques, the application of which may require revision of the National Table of Frequency Allocations;
  - c) Make recommendations to the IRAC for changes in the National Table of Frequency Allocations, as appropriate.
2. Promote electromagnetic compatibility among electronic systems and ensure observance of the provisions of Section 8.2.5 by developing and implementing procedures enabling the Subcommittee to:
  - a) Assemble, maintain, and review pertinent documentation on all planned and operational major spectrum-dependent systems including their technical and operational characteristics;
  - b) Ascertain in the early stages of system review where compatibility may not exist;
  - c) Make recommendations as to potential electromagnetic compatibility problem areas and proposed courses of action to resolve these problems;
  - d) Make recommendations as to technical parameters necessary to facilitate sharing between systems;
  - e) Review as appropriate the effectiveness of existing systems with a view toward rectifying compatibility deficiencies.
3. Respond to IRAC requests for assistance.

b. The SPS shall consist of a representative appointed by each of the following member departments and agencies together with such other departments and agencies as the Deputy Associate Administrator, Office of Spectrum Management may hereafter designate.

Agriculture  
Air Force  
Army  
Coast Guard  
Commerce  
Energy  
Federal Aviation Administration  
Homeland Security  
Interior

Justice  
National Aeronautics and Space Administration  
National Security Agency (Observer)  
National Science Foundation  
Navy  
State  
Treasury  
Transportation  
United States Agency for Global Media

### **Section 4 - The Technical Subcommittee (TSC)**

a. The TSC, chaired by NTIA, shall have as its normal function the carrying out of those functions given in Article II that relate to the technical aspects of the use of the electromagnetic spectrum, and such other matters as the IRAC may direct. In furtherance of the above, on behalf of the IRAC and after coordination with the Deputy Associate Administrator, Office of Spectrum Management the TSC shall:

1. develop recommended new standards and improvement of existing standards pertaining to use of the radio spectrum;
2. maintain awareness of the radio propagation (including natural radio noise) programs and needs of the federal government for purposes of evaluating and making recommendations leading to a better utilization of the radio spectrum;
3. evaluate and make recommendations, in the form of technical reports, on new and existing techniques from the standpoint of their ability to optimize use of the radio spectrum (recommendations to include

implementation steps); and,

4. evaluate and make recommendations, in the form of technical reports, regarding the EMC capabilities and needs of the Federal Government in support of spectrum management, including techniques and criteria leading to greater inter- and intra-radio service sharing of available spectrum and the reduction of man-made radio noise.

5. evaluate current and proposed efforts regarding:

- a) the adequacy of the technical bases for spectrum management;
- b) the effectiveness of specific programs regarding improved use of the spectrum; and
- c) the need for new criteria, procedures, and methodologies for use of the spectrum.

b. The TSC shall consist of a representative appointed by each of the following member departments and agencies together with such other members as the Deputy Associate Administrator, Office of Spectrum Management may hereafter designate.

Agriculture

Air Force

Army

Coast Guard

Commerce

Energy

Federal Aviation Administration

Homeland Security

Interior

Justice

National Aeronautics and Space Administration

National Science Foundation

Navy

Transportation

Treasury

United States Agency for Global Media

c. To the extent feasible, the TSC shall conduct its activities in working groups reporting thereon to the TSC. Any number of department or agency personnel may be appointed to a working group with no distinction being made as to representative or alternate. Each agency's representative (or alternate) on the TSC shall be that agency's coordinator and contact with respect to working group activities.

#### **Section 5 - The Radio Conference Subcommittee (RCS)**

a. The Radio Conference Subcommittee (RCS), chaired by NTIA, shall carry out the mission, functions, and role set forth in Article II related to developing, in coordination with the Secretary of State and other interested agencies, plans, policies, and programs which relate to international telecommunications conferences and negotiations, including preparations for International Telecommunication Union (ITU) associated radio conferences, through the development of agenda item project plans, recommended preliminary views, recommended United States (U.S.) proposals, and recommended Executive Branch positions. In the furtherance of the above, on behalf of the IRAC, the RCS shall:

1. Undertake preparatory work related to international radio conferences;

2. Develop recommended proposals for eventual consideration by the Inter-American Telecommunications Commission (CITEL) and other regional organizations;

3. Maintain close liaison with related conference preparatory activities of the U.S. for the ITU Radiocommunication Sector (ITU-R) including the ITU-R Conference Preparatory Meetings held prior to each World Radiocommunication Conference (WRC), to include, after coordination with the Deputy Associate Administrator, Office of Spectrum Management, coordination of Executive Branch positions and contributions related to WRC agenda items;

4. Coordinate with other U.S. groups considering radio conferences related issues within CITEL and other international and regional organizations such as the North Atlantic Treaty Organization, the European Conference of Postal and Telecommunications Administrations, the International Maritime Organization, the International Civil Aviation Organization (ICAO), the World Meteorological Organization, and the Asia-Pacific Telecommunity;

5. Take into account:

a) Current and planned national and international frequency uses, and the optimum placement of radio services, with a view to the most effective use of spectrum in the overall national interest;

b) The anticipated needs of all radiocommunication services for the future;

c) New developments in existing services;

d) New techniques, the application of which may require revision of regulations concerning radio frequency matter; and

e) New services for which the current regulations makes no provisions.

6. Provide a forum for information sharing and discussion of preparatory activities, including, when

necessary, the development of recommended U.S. proposals and positions related to international conferences such as ITU Plenipotentiary Conferences, ITU Radiocommunication Assembly, and ITU Council as it pertains to matters involving radiocommunications, the Radiocommunication Advisory Group, and the Radio Regulations Board.

b. The RCS shall consist of an appointed federal representative from each of the following member departments and agencies together with such other members as the Deputy Associate Administrator, Office of Spectrum Management may designate.

Agriculture  
Air Force  
Army  
Coast Guard  
Commerce  
Defense Information Systems Agency  
Energy  
Federal Aviation Administration  
Homeland Security  
Interior

Justice  
National Aeronautics and Space Administration  
National Security Agency (Observer)  
National Science Foundation  
Navy  
State  
Transportation  
Treasury  
United States Agency for Global Media

### **Section 6 - The Space Systems Subcommittee (SSS)**

a. The SSS, chaired by NTIA, shall have as its normal function the international registration of federal government satellite systems with the ITU. In the furtherance of the above the SSS shall, on behalf of the IRAC and after coordination with the Deputy Associate Administrator, Office of Spectrum Management, take action to:

1. review, modify, develop, and maintain the procedures for national implementation of the provisions of the ITU Radio Regulations related to space systems;
2. advance publish, coordinate, and notify Federal Government space systems under the applicable provisions of the ITU Radio Regulations;
3. respond to the data furnished by other Administrations and the Radiocommunication Bureau (BR) regarding proposed space telecommunications systems in accordance with the applicable provisions of the ITU Radio Regulations; and
4. process international actions through the FCC.

b. The SSS shall consist of a representative appointed by each of the following member departments and agencies together with such other members as the Deputy Associate Administrator, Office of Spectrum Management may hereafter designate.

Air Force  
Army  
Commerce  
Defense Information Systems Agency  
Energy  
Federal Aviation Administration

Interior  
National Aeronautics and Space Administration  
National Science Foundation  
Navy  
State

c. The FCC Liaison representative shall be NTIA's point of contact for correspondence with the BR and other administrations.

### **Section 7 - The Emergency Planning Subcommittee (EPS)**

a. In general, the EPS, chaired by NTIA, shall formulate, guide, and review National Security and Emergency Preparedness (NSEP) planning for spectrum-dependent systems. In the furtherance of the above, on behalf of the IRAC and after coordination with the Deputy Associate Administrator, Office of Spectrum Management, the EPS shall specifically:

1. review and recommend changes to the NTIA Emergency Readiness Plan for Use of the Radio Spectrum (ERP) to reflect current plans and procedures;
2. assist the Associate Administrator, Office of Spectrum Management in administering a system of radio spectrum priorities for those spectrum-dependent telecommunications resources belonging to and operated by the Federal Government; and

3. ensure emergency spectrum management planning and practices are in accordance with current NSEP telecommunications policy.

b. The EPS shall consist of a representative appointed by each of the following member departments and agencies together with such other members as the Deputy Associate Administrator, Office of Spectrum Management may hereafter designate.

Agriculture	Justice
Air Force	National Aeronautics and Space Administration
Army	National Security Agency (Observer)
Coast Guard	Navy
Commerce	State
Energy	Transportation
Federal Aviation Administration	Treasury
Federal Communications Commission (Liaison)	United States Agency for Global Media
Homeland Security	United States Postal Service
Interior	Veterans Affairs

### **Section 8 - The Secretariat**

a. The Secretariat shall consist of the Executive Secretary, who shall be its principal officer, the Assistant Executive Secretary, and the Secretaries of the Subcommittees and ad hoc groups, together with such clerical and technical personnel as are determined by the Deputy Associate Administrator, Office of Spectrum Management to be necessary to carry out the work of the IRAC.

b. The Executive Secretary shall be responsible for the administration of the affairs of the IRAC and of the Secretariat. The Executive Secretary shall:

1. function as Secretary of the IRAC;
2. appoint the Secretaries of the Subcommittees; and
3. provide the IRAC with the necessary secretarial, clerical, and technical assistance.

c. As the principal officer of the Secretariat, the Executive Secretary shall perform all necessary administrative and staff functions, reporting thereon to the Chairperson of the Committee. The secretaries of the subcommittees and ad hoc groups shall perform all necessary administrative and staff functions, reporting to the Executive Secretary regarding procedures and performance of duties and to the chairperson or convener regarding the activity of the subcommittee or ad hoc group.

## **Article VI - Meetings**

**Section 1** - Meetings of the IRAC, its subcommittees, and ad hoc groups may be called by the associated chairperson. In general, for the convenience of the members and to plan IRAC-related activity, the meetings shall be called for regularly scheduled dates. The chairperson shall also call meetings whenever requested by a majority of its members. When so requested by a majority of the members, and where the chairperson is unavailable, the vice-chairperson, or the Executive Secretary may call a meeting.

**Section 2** - In establishing IRAC agendas, the IRAC Chairperson shall provide the opportunity for open and closed portions. Attendance during the open portion of a meeting is unrestricted except with respect to available space and limitations derived from the need to escort visitors. Attendance during the closed portion of a meeting is restricted to employees of the Federal Government and their assistants (as provided in Article III, Section 1, paragraph e and Article III Section 4). An open portion of the agenda for any given IRAC meeting shall be established only when individuals outside the federal government have requested via the Chairperson to address the IRAC in accordance with procedures given in Chapter 11.

**Section 3** - To the maximum extent practicable, the work of the AAG and the MAG shall be conducted without formal meetings; however, meetings shall be convened at the request of any member.

**Section 4** – While attendance at the meetings continues to be an essential responsibility of agency representatives and is vital to member interaction and the formulation of advice, Chairmen and Conveners may, on an exceptional basis at the request of a member, the FCC or NTIA staff, provide for attendance of unclassified portions of meetings via tele- or videoconference. Considering the number of off-site participants, the practical requirements for the efficient functioning and control of the meeting, and the tools available, the Chairman/Convener may specify

limitations to be placed on the off-site participants. For example, with a large group and no means to recognize requests to speak, the Chairman/Convener may require that off-site participants remain silent or communicate, prior to the meeting, on which items they intend to communicate. The Chairman/Convener could then call on them at the appropriate time. At any point where the Chairman/Convener determines that off-site participation is detracting from the work of the group, he/she may terminate the practice.

## **Article VII - Conduct of Work**

**Section 1** - The work of the IRAC, its subcommittees and ad hoc groups, is not limited to meetings. As necessary and as guided by the respective chairperson or convener, the distribution of documents, provision of agency advice, consolidation of consensus views, voting, and conclusion on recommendations may proceed by electronic means. Thus, much of the work of the IRAC, its subcommittees and ad hoc groups, may occur outside meetings or between meetings.

## **Article VIII - Procedure and Voting**

**Section 1** - Recognizing that business may be conducted outside of meetings, all members of the IRAC, its subcommittees and ad hoc groups are "present" and a quorum always exists for the purpose of conducting business. If a vote is taken at a meeting, then a majority of the members eligible to vote shall constitute a quorum for voting at that meeting. However, the Chairperson may extend the voting outside the meeting to accommodate agencies not present.

**Section 2** - The IRAC, its subcommittees and ad hoc groups, may establish procedures they consider necessary to discharge their duties. All meetings shall be conducted in accordance with parliamentary procedure as outlined in Robert's Rules of Order.

**Section 3** - Each of the members shall have one vote and no proxies may be voted.

**Section 4** - In the event that unanimous agreement on an issue is not obtained, a minority opinion may be filed in the record; the minority opinion shall be forwarded by subcommittees and ad hoc groups to the IRAC and by the IRAC to NTIA, if so requested by any member.

**Section 5** - Motions are carried by a majority of the votes cast.

**Section 6** - An item under consideration by a subcommittee shall be tabled and referred to the IRAC (1) upon the request of any member or the FCC; (2) if it is a matter for which policy has not heretofore been established; or (3) at the request of the IRAC.

**Section 7** - Amendments to these bylaws shall require the approval of not less than two-thirds of the members of the IRAC. Proposals to amend shall be documented and tabled for at least the interval between two regular meetings before they can be acted upon by the IRAC.

## **Article IX - Personnel Security Clearances**

**Section 1** - Representatives, alternates, and observers on the IRAC, its subcommittees and ad hoc groups, shall be cleared for access to SECRET information in accordance with standards established by Executive Order 13526. Their clearances shall be registered with NTIA's security officer.

**Section 2** - Assistants, consultants, advisors, visitors, or guests shall be sponsored by NTIA, a member or an observer and shall possess a security clearance equal to the classification of the information being considered. Such clearances will be in accordance with standards established by Executive Order 13526. Their clearances shall be registered with NTIA's security officer.

**Section 3** - Assistants, consultants, advisors, visitors, or guests not having registered a Secret clearance with the NTIA Security Officer shall be always escorted by their sponsor within the IRAC area.

**Section 4** - Inquiries related to the security clearance of personnel shall be addressed to the Security Officer, National Telecommunications and Information Administration, Herbert Hoover Building, 1401 Constitution Avenue, N.W., Room 4890, Washington, D.C. 20230.

**Section 5** - The Executive Secretary shall maintain a current record of approved clearances and shall make this record available to secretaries of subcommittees and ad hoc groups.

**Section 6** - The IRAC Secretariat will provide, on an annual basis on or before 1 November, to the IRAC Representatives a listing of those representatives or alternates of IRAC, its subcommittees and ad hoc groups that currently hold a security clearance for access to IRAC sponsored meetings. The Representatives will review and amend this list as appropriate and forward it to their respective agency security office for validation of the clearance. The agency security office shall validate the list and return it to the Security Officer, NTIA, by 31 December of each year.

## **Article X - Safeguarding Official Information**

Security information is marked and handled in accordance with Executive Order 13526, e.g., CONFIDENTIAL, SECRET, etc. The proper handling of Controlled Unclassified Information (CUI) is address by Executive Order 13556.

## **Article XI - Documentation Procedures**

**Section 1** - Distribution of documents for consideration by the IRAC (including its subcommittees or ad hoc groups) will be restricted to the NTIA; FCC; member agency representatives or alternates of the IRAC, its subcommittees and ad hoc groups; and observers. Those individuals on distribution for documentation must ensure that the documents are not provided outside the components of the Federal Government whose expertise and support are needed to respond to IRAC-related issues. Those within this distribution, may provide the documentation to their assistants, consultants, and advisors, but must ensure that the documents are used only for official government business to support the members in the conduct of IRAC activity.

**Section 2** - Documents to be considered by the IRAC, its subcommittees or ad hoc groups must be submitted to the IRAC Executive Secretary or applicable secretary in sufficient time (five working days) to be processed and distributed prior to the scheduled meeting. If the document is received after the distribution cutoff date it will be distributed as soon as practicable and will be placed on the agenda of the next scheduled meeting unless waived by the Chairperson (placement on a future agenda does not mean that work cannot proceed until the next meeting.).When the Chairperson waives the cutoff date for a specific document, the Secretariat will distribute the document as soon as possible. Such documents not distributed 24 hours before a meeting, will be provided in hard copy at the meeting in addition to electronic distribution.

**Section 3** - Documents submitted to the IRAC from the subcommittees and ad hoc groups must have the coordination or stated minority non-concurrence of the members of the respective subcommittee or ad hoc group.

**Section 4** - Documents will be distributed electronically as soon after receipt as practicable. Records of documents will be maintained electronically.

## **Article XII - Reports**

IRAC Subcommittee Chairpersons and Ad Hoc Group Conveners will provide status reports to the IRAC in January of each year to cover the previous calendar year. These reports are to include the participant agencies, the accomplishments during the period and the projected completion date of any specific tasks outlined in the terms of reference.

## **1.4 REIMBURSEMENT REGARDING AUTHORIZATION FOR SPECTRUM USE**

Public Law 108–7, div. B, title II, Feb. 20, 2003, 117 Stat. 71, provided in part: “That hereafter, notwithstanding any other provision of law, NTIA [National Telecommunications and Information Administration] shall not authorize spectrum use or provide any spectrum functions pursuant to the National Telecommunications and Information Administration Organization Act, 47 U.S.C. 902–903 [47 U.S.C. 901 et seq.], to any Federal entity without reimbursement as required by NTIA for such spectrum management costs, and Federal entities withholding payment of such cost shall not use spectrum.” Annual appropriation acts for NTIA provide the total amount of the fees to be collected.

**(Last Page in Chapter 1)**



## Chapter 2

### Telecommunication Policy

#### 2.1 OBJECTIVES FOR THE USE OF THE RADIO SPECTRUM APPLYING TO AGENCIES AND ESTABLISHMENTS OF THE FEDERAL GOVERNMENT

The United States (U.S.) is vitally dependent upon the use of the radio spectrum to carry out national policies and achieve national goals. Use of the spectrum is vital to the security and welfare of the Nation and to the conduct of its foreign affairs. This use exerts a powerful influence upon our everyday lives, in countless ways, annually contributing significantly to the Nation's growth and economy.

The radio spectrum is a limited natural resource which is accessible to all nations. It is imperative that the U.S. develop and administer the use of this resource wisely so as to maintain a free democratic society and to stimulate the healthy growth of the Nation, while ensuring its availability to serve future requirements in the best interest of the Nation.

Therefore, consistent with international treaty obligations and with due regard for the rights of other nations, the national objectives for the use of the radio spectrum are to make effective, efficient, and prudent use of the spectrum in the best interest of the Nation, with care to conserve it for uses where other means of communication are not available or feasible. Specifically, in support of national policies and the achievement of national goals, the primary objectives are:

- a. to enhance the conduct of foreign affairs;
- b. to serve the national security and defense;
- c. to safeguard life and property;
- d. to support crime prevention and law enforcement;
- e. to support the national and international transportation systems;
- f. to foster conservation of natural resources;
- g. to provide for the national and international dissemination of educational, general, and public interest information and entertainment;
- h. to make available rapid, efficient, nationwide, and worldwide radiocommunication services;
- i. to promote scientific research, development, and exploration;
- j. to stimulate social and economic progress; and
- k. to improve the well-being of man.

The following areas of interest are associated with the national objectives listed above:

- Agriculture
- Amateur (emergency preparedness, self-training, and technical investigation)
- Commerce
- Computers and data processing
- Consumer expenditures and savings
- Education
- Entertainment (Broadcasting)
- Health
- International (AID, conduct of Foreign Affairs and information exchange)
- Natural resources (including pollution abatement)
- National Security and defense
- Oceanography
- Public safety
- Research and development
- Outer space
- Social welfare
- Transportation (other than urban areas)
- Urbanization (housing, transportation, and telecommunications)

These areas of interest are identified to assist in the frequency management process and are not intended to be all inclusive. Priorities among these areas of interest are normally determined on a case-by-case basis and are dependent upon many factors, including past and foreseen political and administrative decisions.

## 2.2 FORMULATION OF TELECOMMUNICATIONS POLICY

1. The formulation and enunciation of national telecommunication policies designed to ensure achievement of the national objectives is an essential element of the role of the Federal Government. Telecommunication policies are made by the Congress, by the Court, by the President and the Assistant Secretary of Commerce for Communications and Information with respect to the agencies and establishments of the Federal Government, and by the Federal Communications Commission for the public. Policy is made through treaties to which the U.S. adheres with the advice and consent of the Senate, through executive agreements, by executive departments and agencies in the discharge of their telecommunication responsibilities, and by custom and precedent. These policies may be separated into three categories: National Telecommunication Policy; Telecommunication Policy applying to the agencies and establishments of the Federal Government; and Federal Communications Commission Telecommunication Policy.

2. The Congress, in the Communications Act of 1934, provided for the regulation of interstate and foreign commerce in communication by wire and radio "so as to make available, so far as possible, to all the people of the U.S. a rapid, efficient, nationwide, and world-wide wire and radio communication service, with adequate facilities at reasonable charges, for the purpose of the national defense, for the purpose of promoting safety of life and property through the use of wire and radio communication," and created the Federal Communications Commission to execute and enforce the provisions of that Act. Sections 301 and 303 of the Act set forth the general powers of the Commission to regulate radio stations and stipulate that such stations cannot be operated except under and in accordance with the Act and with a license granted under the provisions of the Act. The Congress, by Section 305 of the Act, excluded "Radio stations belonging to and operated by the United States" from the provisions of Sections 301 and 303 of the Act. It provided that all such stations use such frequencies as shall be assigned by the President.

3. The Congress, in the Communications Satellite Act of 1962, declared: "...it is the policy of the United States to establish, in conjunction and in cooperation with other countries, as expeditiously as practicable a commercial communications satellite system, as part of an improved global communications network, which will be responsive to public needs and national objectives, which will serve the communication needs of the United States and other countries, and which will contribute to world peace and understanding.... United States participation in the global system shall be in the form of a private corporation, subject to appropriate governmental regulation.... It is not the intent of Congress by this Act to preclude the use of the communications satellite system for domestic communication services where consistent with the provisions of this Act nor to preclude the creation of additional communications satellite systems, if required to meet unique governmental needs or if otherwise required in the national interest." The Congress provided in Section 201 of the Act: "In order to achieve the objectives and to carry out the purposes of this Act-(a) the President shall-... (7) so exercise his authority as to help attain coordinated and efficient use of the electromagnetic spectrum and the technical compatibility of the system with existing communications facilities both in the United States and abroad...."

4. The President by Reorganization Plan No. 1 of 1977 and Executive Order 12046 of March 26, 1978, established the Assistant Secretary of Commerce for Communications and Information and delegated to the Secretary of Commerce the authority to:

- a. Assign frequencies to Federal radio stations and classes of stations, and amend, revoke or modify such assignments;
- b. Authorize a foreign government to construct and operate a radio station at the seat of the U.S. Government;
- c. Help attain coordinated and efficient use of the electromagnetic spectrum and the technical compatibility of the communications satellite system with existing communications facilities both in the U.S. and abroad;
- d. Develop and set forth, in coordination with the Secretary of State and other interested agencies, plans, policies and programs relating to international telecommunication issues, conferences and negotiations;
- e. Coordinate preparations for participation by the U.S. in international telecommunication conferences;
- f. Coordinate policies and standards for spectrum use and related emergency readiness activities with the Executive Branch;
- g. Ensure that the Executive Branch's views on telecommunication matters are effectively presented to the Federal Communications Commission;
- h. Establish policies concerning the use of the spectrum by Federal Government agencies; and
- i. Develop, in coordination with the Federal Communications Commission, a comprehensive long-range plan for improved management of the spectrum.

## **2.3 TELECOMMUNICATIONS POLICY APPLYING TO AGENCIES AND ESTABLISHMENTS OF THE FEDERAL GOVERNMENT**

The following policies have been established regarding the use of telecommunications by the agencies and establishments of the Federal Government:

### **2.3.1 General**

#### **Telecommunication Development and Regulation**

The Federal Government shall encourage the development and regulate the use of radio and wire communications subject to its control to meet the needs of national security, safety of life and property, international relations, and the business, social, educational, and political life of the Nation.

#### **International Telecommunication Regulation**

1. The Federal Government considers the International Telecommunication Union the principal competent and appropriate international organization for the purpose of formulating international regulations on telecommunication matters.

2. The Federal Government recognizes that other international bodies, such as the International Civil Aviation Organization, International Maritime Organization and the World Meteorological Organization are appropriate international organizations for considering specialized telecommunication matters.

3. The U.S. shall be appropriately represented at international conferences dealing with telecommunications when such conferences appear to involve its national interests.

4. The Federal Government shall foster and encourage the participation, for the purpose of coordination and provision of advice and information, of experts from its commercial communication, scientific, and educational communities as advisers in the preparation for and participation in international telecommunication conferences, in consonance with national policy and security considerations.

#### **Operating Capability of Industry**

The Federal Government regards the operating capability of the privately-owned telecommunication industry as a vital national asset and shall encourage and promote the development of that industry in consonance with other national policy and security considerations.

### **2.3.2 Functions to be Achieved**

#### **National Defense**

1. The U.S. in time of war or national emergency, as proclaimed by the President, shall have available to the Federal Government the total telecommunication resources of the Nation for utilization with due regard to the extent of the war or emergency and to the continuing operation of services considered to be essential or desirable for the welfare and interest of the United States during such a time.

2. On a continuing and current basis, all common carriers shall be encouraged and assisted in planning and preparing for their immediate readiness to meet emergency or war conditions so that telecommunications responsiveness to National Security Emergency Preparedness requirements can be instantaneous with the occurrence of such conditions.

3. In advance of war or a national security emergency, all desirable and possible measures and procedures necessary for use during emergency or war conditions will be developed and made available as needed so that they can be affected concurrently with the onset or threatened onset of emergency war conditions.

#### **Safety at Sea**

The Federal Government shall aggressively foster the development, investigation, selection, and standardization of a worldwide system of radio and electronic aids for marine navigation and communication, since the national

security, the Nation's sea commerce, and the assurance of adequate safety of life and property at sea for ships of all nations require such an efficient, integrated, and standardized system.

### **Safety in the Air**

The Federal Government shall aggressively foster the development, investigation, selection, and standardization of a worldwide system of radio and electronic aids for air navigation and communication, since the national security, the Nation's air commerce, and the assurance of adequate safety of life and property in flight require such an efficient, integrated, and standardized system.

### **Protection of Life, Property, and National Resources**

The Federal Government shall promote the development and use of radio for the protection of the lives and property of its citizens and of other national resources where other means of communication are not appropriate or available.

### **Research**

The Federal Government shall foster such research and development activities in the telecommunication field as will permit and encourage the most beneficial use of the radio spectrum in the national interest.

### **Promotion of Efficiency and Economy of Federal Government Operations**

The Federal Government shall promote the development and use of radio to improve the efficiency and economy of Federal Government operations where other means of communication are not appropriate or available.

## **2.3.3 Federal Government Use of Commercial Telecommunication Service**

1. The Federal Government places heavy reliance on the private sector in providing telecommunication service for its own use. This means that all functions normally associated with providing the service shall be performed by the private sector. These functions include design, engineering, system management and operation, maintenance, and logistical support.

2. In order to emphasize the Federal Government's proper role as a user, any proposal designed to provide needed telecommunication service, which requires the Federal Government to perform any of the "provider" functions, such as those listed above, shall be adopted only if commercial service is:

- a. not available to the user during the time needed;
- b. not adequate from either a technical or operational standpoint; or
- c. significantly more costly.

3. A non-commercial service approach is acceptable if such an approach will result in significant savings over an otherwise acceptable commercial service offering. To be considered significant the savings must exceed 10% of the cost of the commercial service. The cost estimate of the non-commercial approach must include, as a minimum, all of the factors called out by Office of Management and Budget Circular A-76. If the proposed approach involves heavy investment, rapid obsolescence, or uncertain requirements, the minimum savings threshold should be increased to reflect these factors.

4. The Federal Government shall establish separate communication satellite systems only when they are required to meet unique governmental needs or are otherwise required in the national interest.

## **2.3.4 Use of Space Radiocommunication Techniques in the Aeronautical Services**

The Federal Government shall promote the use of space radiocommunication techniques in the aeronautical services when economy of operation, improved service, and the more effective use of the radio spectrum will thereby result. The Federal Government shall promote the use of frequencies in the band 1535-1660 MHz for the aeronautical mobile (R) service for international civil aviation operations.

### **2.3.5 Role of Leadership by the Federal Government**

The Federal Government shall exercise leadership in the application of technological advances of operational procedures that will result in more efficient and effective use of the radio spectrum. Periodically, it shall measure the status of current technical and operational capabilities to determine necessary changes in technical standards, allocations, or assignments which should be affected.

### **2.3.6 Radio Spectrum Administration**

1. The Federal Government regards the radio frequency spectrum as a world resource in the public domain; consequently, it shall adopt policies and measures to ensure that this resource is used in the best interest of this Nation, but with high regard to the needs and rights of other nations.

The supervision and administration of Federal use of the radio frequency spectrum shall have the objective of assuring that such use is efficient, effective, and prudent.

2. The Federal Government considers the radio frequency spectrum to be a vital national resource. Any rights of United States users to operate on any radio frequency are rights held by the United States as a whole. Such rights may be transferred by the Federal Government from one user to another, as required in the overall national interest.

3. The Federal Government considers that the basic guide to follow in the normal assignment of radio frequencies for transmission purposes is the avoidance of harmful interference and the use of frequencies in a manner which permits and encourages the most beneficial use of the radio frequency spectrum in the national interest.

4. Within the jurisdiction of the Federal Government, use of the radio frequency spectrum for radio transmissions for telecommunications or for other purposes shall be made by Federal Government stations only as authorized by the Assistant Secretary.

5. In view of the limitations of the usable radio frequency spectrum, and to ensure the best possible return from the use thereof, in time of peace, the Federal Government shall require all users to:

- a. justify any except an emergency request for radio frequencies prior to the assignment or use of such frequencies;
- b. confirm periodically the justification of continued use;
- c. employ up-to-date spectrum-conserving techniques as a matter of normal procedure; and
- d. ensure the ability to discontinue the electronic functioning of any emission system including satellites when required in the interest of communication efficiency and effectiveness.

6. In recognition of the congestion of that portion of the radio frequency spectrum, which is suitable for long-distance communication, only in exceptional circumstances shall frequencies below 30 MHz be assigned in the domestic fixed service.

7. Normally, radio frequencies shall be assigned in the following order:

- a. Frequencies used primarily, predominantly, and directly for national security and defense, for purposes which are vital to the safety of the Nation.
- b. Frequencies used primarily, predominantly, and directly to safeguard life and property in conditions of distress.
- c. Frequencies used primarily, predominantly, and directly to safeguard life and property in other than conditions of distress where other means of communication are not available.
- d. Frequencies used in scientific research and those used in services that have no adequate means of rapid communication when such use is considered to be necessary or desirable in the national interest.
- e. Frequencies used for all other purposes, the assignment of which must be judged upon the merits of the intended use.

### **2.3.7 Spurious Emissions**

1. In principle, spurious emissions from stations of one radio service shall not cause harmful interference to stations of the same or another radio service within the recognized service areas of the latter stations, whether operated in the same or different frequency bands.

2. Providing that appropriate spectrum standards in Chapter 5 are met, an existing station is recognized as having priority over a new or modified station. Nevertheless, engineering solutions to mitigate interference may require the cooperation of all parties involved in the application of reasonable and practicable measures to avoid causing or being susceptible to harmful interference.

### 2.3.8 Ionosphere Sounders

1. Ionosphere sounders have demonstrated their value in providing data for:
  - a. increasing scientific knowledge of the Earth's atmosphere;
  - b. real-time evaluation of propagation conditions to increase the reliability of high frequency communications;
  - c. real-time monitoring of upper atmosphere phenomena;
  - d. improving utilization of the radio spectrum;
  - e. predicting disturbed ionosphere conditions; and
  - f. enhancing survival communications, particularly in a nuclear environment.
2. Since uncontrolled growth in the number of ionosphere sounder transmitters could result in mutual, harmful interference among them and could be a potential source of harmful interference to established radio services, radio frequency support for ionosphere sounder transmitters shall be affected only in accordance with the provisions of Sections 8.2.21 and 8.2.22.

### 2.3.9 Safety Service

1. ITU Radio Regulation **1.59** defines a safety service as "any radiocommunication service used permanently or temporarily for the safeguarding of human life and property". The intent of RR **1.59** is that the safety service connotation should be applied to individual uses (assignments) of the radio frequency spectrum, irrespective of the radio service normally applied. This is a very important point since assignments which do entail the providing of a safety-of-life function require an appropriate degree of protection. It does not mean that such assignments have any special status which would in any way alter the normal rules applied with respect to primary, and secondary allocations, noting that priority of communications is otherwise provided in the Radio Regulations (Articles **44** and **53**).
2. From a spectrum management point of view, the domestic and international policies regarding safety service are consistent. Accordingly, the following guidance is applicable:
  - a. The protection and status afforded to the categories of services and allocations and to stations in all services is governed, inter alia, by Art. **5**, Sec. II. ITU Radio Regulations (RR).
  - b. Request for assistance in the case of harmful interference (RR **1.169**) caused to stations of the radionavigation service in a frequency band where the service is allocated under the Table of Frequency Allocations on a secondary basis would be treated by terms of RR **5.28** through **5.31**.
  - c. Request for assistance in the case of harmful interference (RR **1.169**) caused to stations of the radionavigation service in a frequency band where the service is allocated under the Table of Frequency Allocations on a coequal primary basis would be treated in accordance with normal practices based upon which operation was first brought into use unless it can be demonstrated that a "safety-of-life function is being served." In other words, any radiocommunication service, which uses the spectrum for safety purposes may be regarded in that case as a safety service and, in this respect, the appropriate provisions of the Radio Regulations would apply.

### 2.3.10 Use of Spectrum Conserving Methods for Radio Communication Systems

The Federal Government, in its role of leadership in the application of advanced technology, shall foster the application of spectrum-conserving methods for radio communication systems used by the Federal Government. Spectrum-conserving systems are new or existing systems that make use of innovative designs or unique applications that result in efficient use of frequency, space, and time. Efficient use is a mission-oriented factor that combines the requirements of the mission with available techniques to provide the most effective solution. Federal agencies are encouraged to use spectrum conserving technologies and methods where they will satisfy agency operational requirements and will enhance service, economy of operation, and the more efficient and effective use of the radio spectrum. However, where spectrum is readily available due to geographic considerations or other factors, or where mission requirements mandate, security, economics, or some technical or system performance criterion may be the determining factor in system selection.

#### 2.3.10.1 Land Mobile Systems

1. Spectrum conserving methods that should be considered for land mobile operations include trunked systems, narrowband Frequency Modulation (FM) (NBFM), and amplitude-compandored single sideband (ACSSB).

- a. Trunking is a technique that uses dynamic channel assignment to potentially obtain a higher degree of channel loading and increased spectrum utilization.
  - b. NBFM is conventional FM with channel spacing of 12.5 kHz or less. It may be capable of interoperation with conventional FM equipment using 25 kHz channel spacing.
  - c. ACSSB is a single-sideband modulation scheme with a necessary bandwidth of approximately 3.0 kHz, a standardized pilot carrier for synchronization, and amplitude-compressing.
2. The Federal Government shall foster the development of and standards for trunked land mobile systems used in appropriate bands allocated to the Federal Government.
  3. The Federal Government shall foster the development of, and standards for, narrowband land mobile systems used in appropriate band allocated to the Federal Government. Further, to implement the objectives of the "Land Mobile Spectrum Efficiency Plan", submitted to Congress in October 1993 (IRAC Doc. 28497), mandated in the National Telecommunications Authorizations Act of 1992, P.L.102-538) (IRAC Doc. 27964), the Federal Government shall institute plans to narrowband land mobile systems operating in the following bands and in accordance with the following schedule:
    - a. After January 1, 1995, all new systems, and after January 1, 2005, all systems in the 162-174 MHz band must conform to the provision of paragraph 4.3.7A of this manual.
    - b. After January 1, 1995, all new systems and after January 1, 2008, all systems in the 406.1-420 MHz band must conform to the provisions of paragraph 4.3.9 of this manual.
    - c. After January 1, 1997, all new systems and after January 1, 2008, all systems in the 138-150.8 MHz band must conform to the technical standards contained in paragraph 5.3.5.2 of this manual.

### **2.3.11 Reserved**

### **2.3.12 Proof of Compliance with FCC Licensing Requirements**

Section 104(e) of the National Telecommunications and Information Administration Organization Act, as amended, requires that NTIA have proof of compliance with FCC licensing requirements for non-government operations of a radio station utilizing a government frequency or utilization of a government radio station for non-government purposes. Federal agencies must include the FCC file number of any non-government entity using government facilities or radio frequencies for non-government purposes in the application for an NTIA frequency assignment.<sup>1</sup>

### **2.3.13 Special Conditions for Department of Defense Use of the Spectrum**

1. As mandated by Title X, Subpart G, Section 1062 of the National Defense Authorization Act for Fiscal Year 2000, the Department of Defense shall not surrender use of any band of frequencies in which the Department of Defense is a primary user for non-federal use, unless the following conditions are met.

a. NTIA, in consultation with the FCC, has identified and made available to the Department of Defense for its primary use<sup>2</sup>, if necessary, an alternative band or bands of frequencies with comparable technical characteristics as a replacement; and,

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<sup>1</sup> See IRAC Doc. 28420/1-2.2.5.

<sup>2</sup> As used in this Section, a "band of frequencies in which the Department of Defense is a primary user" is a band of frequencies, or part thereof, listed in the National Table of Frequency Allocations under the Federal Government column heading allocated on a primary basis to any radiocommunication service in which the Department of Defense operates spectrum-dependent equipment, as evidenced by one or more operational frequency assignment authorizations listed in the Government Master File for one or more primary services in that band, and as determined by NTIA, in consultation with the Office of the Secretary of Defense and the Joint Staff, based upon:

- (1) the number of permanent and temporary authorizations,
- (2) the number of current and planned systems,
- (3) the geographical areas of operation,
- (4) the amount of bandwidth occupied,
- (5) the cost of reaccommodating systems, or
- (6) the nature of the essential national security mission supported in the band.

The provisions of Title X, Subpart G, Section 1062 of the National Defense Authorization Act for Fiscal Year 2000 shall not apply to Federal Government stations operating as "end-users" with non-federal systems.

b. The Secretary of Commerce, the Secretary of Defense, and the Chairman of the Joint Chiefs of Staff have jointly certified to the Committee on Armed Services and the Committee on Commerce, Science and Transportation of the Senate; and the Committee on Armed Services and the Committee on Commerce of the House of Representatives, that the replacement band or bands of frequencies identified in a. above provides comparable technical characteristics to restore essential military capability that will be lost when the band of frequencies is surrendered.

2. Paragraph 1. shall not apply to any band or bands of frequencies identified for reallocation in accordance with Title VI of the Omnibus Budget Reconciliation Act of 1993 (Public Law 103-66; 107 Stat. 379) and Title III of the Balanced Budget Act of 1997 (Public Law 105-33, 111 Stat. 258), other than a band or bands of frequencies reclaimed in accordance with Title X, Subtitle G, Section 1062 of the National Defense Authorization Act for Fiscal Year 2000 (The 139.0-140.5 MHz, 141.5-143.0 MHz, and the 1385-1390 MHz bands identified for reallocation under the Balanced Budget Act of 1997).

3. Other than when implementing the provisions of this Section, nothing in Paragraph 1 shall abridge the authority of NTIA to assign frequencies to radio stations or classes of radio stations belonging to and operated by the U.S., including the authority to amend, modify, or revoke such assignments

## **2.4 BASIC COORDINATION ARRANGEMENT BETWEEN NTIA AND THE FCC WITH RESPECT TO DECISIONS REGARDING THE USE OF THE RADIO SPECTRUM**

### **2.4.1 The Following Arrangement Was Agreed Upon by the NTIA and the FCC August 1, 2022**

1. The Chair of the FCC and the Assistant Secretary for Communications and Information will meet at least quarterly to conduct joint spectrum planning with respect to:

- a. the extent to which licenses for spectrum use can be issued pursuant to section 309(j) of the Communications Act of 1934;
- b. the future spectrum requirements for federal and non-federal uses, including State and local government public safety agencies;
- c. the spectrum allocation actions necessary to accommodate those uses;
- d. the actions necessary to promote the efficient and effective use of the spectrum, including spectrum management techniques to promote increased reallocation and/or shared uses of the spectrum that do not cause harmful interference, as a means of increasing commercial and federal access;
- e. where possible and appropriate, the identification of spectrum management policies or spectrum allocations to be examined in the next 12 months; and
- f. other spectrum related matters as appropriate.

2. The staffs of the FCC and the NTIA will meet at least monthly to exchange information of mutual interest concerning, but not limited to, the above-referenced issues. To the extent possible, such meetings will include the identification of, and tentative schedules for, upcoming proposed actions and activities and may include detailed subject-matter briefings as appropriate, including about current and anticipated future uses of spectrum.

3. The FCC will cooperate with the NTIA and endeavor to give notice of all proposed actions that could potentially cause interference to federal operations, including operations in adjacent spectrum allocations. Where possible, such notice will be given in time for the NTIA to comment prior to final action and a minimum of 20 business days prior to final action. The FCC will endeavor to give NTIA the same notice and opportunity to comment, in instances in which NTIA notifies the FCC that non-federal operations critical to federal agency missions, including those essential to national security or safety of life, could potentially experience harmful interference from a proposed action. A different review period may be agreed to by NTIA's Associate Administrator for Spectrum Management and the FCC's Chief of the Office of Engineering and Technology. Where applicable, FCC staff will endeavor to engage NTIA staff in discussions regarding NTIA's comments on the FCC action. Final action by the FCC, however, does not require approval of the NTIA.

4. The NTIA will cooperate with the FCC and endeavor to give notice of all proposed actions that could potentially cause interference to non-federal operations. Where possible, such notice will be given in time for the FCC to comment prior to final action and minimum of 20 business days prior to final action. A different review period may be agreed to by NTIA's Associate Administrator for Spectrum Management and the FCC's Chief of Office of Engineering and Technology. Where applicable, NTIA staff will endeavor to engage FCC staff in discussions regarding FCC's comments on the NTIA action. Final action by the NTIA, however, does not require



approval of the FCC.

5. The FCC and the NTIA commit to improved and effective communication on matters that relate to the management of the nation's spectrum resource.

a. The staffs of FCC and the NTIA will engage, on an ongoing basis, in engineering collaboration to, for example, identify best practices, develop metrics for effective spectrum analysis, and examine technologies to enhance spectrum use.

b. To facilitate evidence-based spectrum policy-making, in particular when participating in each other's public proceedings, the FCC and the NTIA will endeavor to do so on a timely basis through contributions supported by relevant technical data and analysis based on sound engineering principles, including available test and receiver performance data, where appropriate. Such information will be of a quality that complies with best engineering practices and any mutually agreed standards or procedures.

c. The FCC and the NTIA will endeavor to provide relevant and appropriate information, including, but not limited to, the nature of federal and nonfederal operations and uses of spectrum in their spectrum coordination communications, ensuring appropriate treatment of any sensitive and classified information. The FCC and the NTIA will also identify, as early in the decision-making processes as possible, any technical issues that have a reasonable likelihood of generating disputes or disagreements, and will act in their capacities as the sole agencies responsible for managing spectrum use in the United States to further assess such issues.

6. The FCC and the NTIA will resolve technical, procedural, and policy differences by consensus whenever possible.

7. The staffs of the FCC and the NTIA will cooperate to develop and implement a process through which evidence-based concerns of either agency about harmful interference posed by a proposed final action by the FCC or the NTIA can be escalated. If such concerns cannot be resolved between NTIA's Associate Administrator for Spectrum Management and the FCC's Chief of the Office of Engineering and Technology, the matter may be referred to the Assistant Secretary of Commerce for Communications and Information and the FCC Chair for consideration before final action.

8. The FCC and the NTIA will maintain current lists of their authorized frequency assignments and will exchange such information as appropriate to coordinate spectrum use.

9. The full Memorandum of Understanding between the FCC and the NTIA can be found here: <https://ntia.gov/other-publication/2022/memorandum-understanding-between-fcc-and-ntia>.

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## **Chapter 3**

### **International Matters**

#### **3.1 TREATIES AND AGREEMENTS**

1. The primary treaties and other international agreements in force relating to radio communication and to which the United States (U.S.) is a party are as follows:

2. The International Telecommunication Convention was signed at Nairobi on November 6, 1982. The U.S. deposited its instrument of ratification on January 7, 1986.

3. The Radio Regulations annexed to the International Telecommunication Convention were signed at Geneva on December 6, 1979 and entered into force with respect to the U.S. on January 1, 1982.

4. The U.S.-Canada Agreement relating to the Coordination and Use of Radio Frequencies Above 30 Megacycles per Second was affected by an exchange of notes at Ottawa on October 24, 1962. A revision to the Technical Annex to the Agreement, made in October 1964 in Washington, was affected by an exchange of notes signed by the U.S. on June 16, 1965 and by Canada on June 24, 1965. The revision entered into force on June 24, 1965. A revision to this Agreement to add Arrangement E (Arrangement of the Department of Communications of Canada between Industry Canada and the National Telecommunications and Information Administration and the Federal Communications Commission of the U.S. concerning the use of the 406.1 to 430 MHz band in Canada-United States Border Areas) was effected by an exchange of notes signed by the U.S. on February 26, 1982 and Canada on April 7, 1982 and became effective on April 7, 1982. Another revision to this Agreement to add Arrangement F (Arrangement Between the Department of Communications of Canada and the Federal Communications Commission of the U.S. Concerning the Use of the Band 806-890 MHz along the Canada- U.S. Border) was affected by an exchange of notes signed by Canada on November 2, 1993 and by the U.S. on January 4, 1994 and became effective on January 4, 1994. An additional revision to this Agreement to add Arrangement G (Sharing Arrangement Between the Department of Industry of Canada and the Federal Communications Commission of the United States of America Concerning the Use of the Frequency Bands 764 to 776 MHz and 794 to 806 MHz by the Land Mobile Service along the Canada-United States Border) was affected by an exchange of notes signed by Canada on June 15, 2005 and by the U.S. on June 20, 2005 and became effective on June 20, 2005.

5. Inquiries concerning the purchase of copies of the International Telecommunication Union (ITU) Constitution and Convention, the Radio Regulations, and the partial revisions thereto, should be sent to the Sales and Marketing Division, International Telecommunication Union, Place des Nations, CH-1211 Geneva 20, Switzerland. Inquiries concerning the substance of the publications should be addressed either to the Office of International Communications and Information Policy, Department of State, or to the Assistant Secretary of Commerce for Communications and Information.

6. Inquiries concerning copies of the U.S.-Canada Agreement should refer to "Treaties and Other International Acts Series 5205 and 5833" and should be sent to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC.

#### **3.2 THE INTERNATIONAL TELECOMMUNICATION UNION**

1. The International Telecommunication Union (ITU) was established in 1865 to manage the first international telegraph networks. The ITU is a specialized agency of the United Nations (UN) headquartered in Geneva, Switzerland. It also has a number of regional and sub-regional offices. It is responsible for international frequency allocations, worldwide telecommunications standards and telecommunication development activities. The ITU is unique among international organizations in that it was founded on the principle of cooperation between governments and the private sector. One hundred ninety-one countries are members of the ITU. Any administration (country) that accedes to the ITU Convention can become a member of the union. Member countries have voting privileges in all ITU Organs. International and regional organizations with an interest in telecommunications, public and private operators, broadcasters, and scientific and industrial companies can become members of components of the ITU known as sectors. Sector members participate in most Union activities on an advisory basis but do not have voting rights. There are over 700 Sector Members and Associate Members. Additional information on the ITU can be found at [www.itu.int](http://www.itu.int).

2. The broad functions of the ITU are the regulation, coordination and development of international

telecommunications. The U.S. is an active member of the ITU and its work is considered critical to the interests of the U.S.

### **3.2.1 Purposes of the Union**

1. The ITU's mission is to enable the growth and sustained development of telecommunications and information networks, and to facilitate universal access so that people everywhere can participate in, and benefit from, the emerging information society and global economy. The ability to communicate freely is a pre-requisite for a more equitable, prosperous and peaceful world. The ITU assists in mobilizing the technical, financial and human resources needed to make this vision a reality.

2. The purposes of the Union are to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including those using satellite orbits and the radio astronomy service, and to carry out studies and approve recommendations on radiocommunication matters, develop information and communication technology/telecom standards to meet the needs of industry and consumers, and to ensure world-wide interoperability and promote the right to communicate of all inhabitants of the planet through access to infrastructure and information and communication services.

### **3.2.2 Structure of the Union**

The ITU Constitution states that the Union shall comprise: the Plenipotentiary Conference, which is the supreme authority of the Union; the Council, which acts on behalf of the Plenipotentiary Conference; world conferences on international telecommunications; the Radiocommunication Sector, including world and regional radiocommunication conferences, radiocommunication assemblies and the Radio Regulations Board; the Telecommunication Standardization Sector, including world telecommunication standardization conferences; the Telecommunication Development Sector, including world and regional telecommunication development conferences; and the General Secretariat.

### **3.2.3 Plenipotentiary Conference**

The Plenipotentiary Conference is convened every 4 years. This conference adopts the fundamental policies of the Union and decides its organization and activities by means of a treaty known as the International Telecommunication Constitution and Convention. These Conferences focus on long-term policy issues. They take decisions on draft Strategic Plans submitted by the Council outlining the objectives, work, programs and expected outcome for each constituent of the Union until the following conference. Plenipotentiary Conferences elect members of the Council, the Secretary-General and Deputy Secretary-General, the Bureau Directors in the three Bureau Sectors of the ITU, and the members of the Radio Regulations Board. ITU Member States control the events at Plenipotentiary Conferences; Sector Members may attend the Conferences as observers.

### **3.2.4 The Council**

The Council of the ITU is composed of 25% (46 Members) of the total number of member states, which are elected by the Plenipotentiary Conference, with due regard to the need for equitable distribution of the seats on the Council among the five world regions (The Americas, Western Europe, Eastern Europe, Africa, Asia and Australasia). The role of the Council is to consider, in the interval between two Plenipotentiary Conferences, broad telecommunication policy issues in order to ensure that the Union's policies and strategy fully respond to the constantly changing telecommunication environment. The Council is responsible for ensuring the efficient coordination of the work of the Union and for exercising an effective financial control over the General Secretariat and the three sectors. The Council takes all steps to facilitate the implementation by members of the provision of the Constitution, the Convention, the Administrative Regulations of the Plenipotentiary conferences and, where appropriate, of the decisions of other conferences and meetings of the Union. Additional information regarding the Council is located at <https://www.itu.int/en/council/Pages/overview.aspx>.

### **3.2.5 General Secretariat**

The General Secretariat manages the administrative and financial aspects of the Union's activities, including

the provision of conference services, information services, long-range strategic planning, and corporate functions (communications, legal advice, finance, personnel and common services). The General Secretariat's work in managing the Union's many meetings, regional and international assemblies and conferences covers organizational and logistical support, the provision of administrative services, documentation, and the provision of translation and interpretation services in the six working languages of the Union. In addition, its work involves providing legal advice, communication support and media relations services for these events. Through an extensive document preparation and handling center, the General Secretariat is also charged with the production and printing of documents and publications as well as with marketing, sales and dispatch of publications to customers worldwide. The management of the finances of the Union is also the responsibility of the General Secretariat. Activities include advising and informing the membership and legislative bodies of the Union on financial and budgetary matters, preparation of the Union's draft budget, preparation of cost analysis, and financial reporting. Additional information regarding the General Secretariat is located at <http://www.itu.int/net/gs/index.aspx> .

### **3.2.6 Radiocommunication Sector**

The Radiocommunication Sector (ITU-R) ensures the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including those using the geostationary-satellite orbit, and carries out studies without limit of frequency range on the basis of which recommendations are adopted. Subjects covered include: spectrum utilization and monitoring; inter-service sharing and compatibility; science services; radio wave propagation; the fixed satellite, fixed, and mobile services and sound and television broadcasting. The Radiocommunication Sector operates through World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by study groups (legislative functions), an Advisory Group (strategic advice) and a Bureau headed by a Director (administrative functions). Additional information regarding the Radio Communication Sector is located at <http://www.itu.int/ITU-R/index.asp>.

### **3.2.7 Telecommunication Standardization Sector**

The Telecommunication Standardization Sector (ITU-T) studies technical, operating and tariff questions and issues recommendations with a view to standardizing telecommunications on a worldwide basis, including recommendations on interconnection of radio systems in public telecommunication networks and on the performance required for these interconnections. Activities cover: telecommunication services and network operation; telecommunication tariffs and accounting principles; maintenance; protection of outside plant; data communication; terminal for telematic services; switching, signaling and man-machine language; transmission performance, systems and equipment; and Integrated Services Digital Network (ISDN). The Standardization Sector operates through World Telecommunication Standardization Conferences which are supported by study groups (legislative) and convened every 4 years, and an Advisory Group on Standardization (strategic advice) and a Standardization Bureau headed by a Director (administrative function). Additional information regarding the Standardization Sector is located at <http://www.itu.int/ITU-T/index.html>.

### **3.2.8 Telecommunication Development Sector**

The Telecommunication Development Sector (ITU-D) activities include policy and regulatory advice, advice on the financing of telecommunications and on low-cost technology options, assistance in human resource management, and the development of initiatives targeting rural development and universal access. Throughout all these activities, ITU-D maintains a strong emphasis on brokering partnerships with the private sector, with a view on harnessing the commercial drive of industry to meet the needs of developing nations. The World Telecommunication Development Conference (WTDC) provides direction to the Telecommunications Development Bureau (BDT), setting guidelines for development priorities, planning BDT activities and establishing the Bureau's work program. WTDC also establishes study groups to undertake studies on issues of relevance to developing countries, including development policies, financing, network planning, and introduction of new services, and is charged with examining the reports of such study groups. Additional information regarding the Development Sector is located at <http://www.itu.int/net/ITU-D/index.aspx>.

### **3.3 SUBMISSION OF INFORMATION TO THE ITU**

1. Frequencies assigned to federal radio stations pursuant to No. **11.2** of the ITU Radio Regulations (RR) shall be notified to the Radiocommunication Bureau, Geneva, Switzerland except as noted in paragraph 3.3.1.2.<sup>1</sup>
2. The Rules of Procedure (RoP) and the Preface to the International Frequency Information Circular (IFIC) should always be consulted prior to making any submissions to the ITU.

#### **3.3.1 Provision of Information Regarding Satellite Networks in Planned Satellite Systems**

1. In order to ensure compliance with the provisions of the ITU Radio Regulations, any federal agency intending to establish a satellite system shall provide to the Spectrum Planning Subcommittee (SPS) and the Space Systems Subcommittee (SSS) the details contained in Appendix 4 to the ITU Radio Regulations (RR) for each satellite network within the planned satellite system, including changes in the technical characteristics and the employment and deployment of stations contained therein.
2. The information in Appendix 4 shall be furnished to the SPS in accordance with the instructions appearing in Chapter 10 of this Manual.
3. The information in Appendix 4 shall be furnished to the SSS in accordance with the current ITU Radio Regulations and applicable BR Circular Letters. The Appendix 4 information required for advance publication shall be provided to the SSS at the same time as the request for Stage 2 Systems Review under Chapter 10 of this manual, and shall not normally be transmitted to the BR for advance publication until Stage 2 certification of Spectrum Support has been granted or earlier if sufficient information is available. The Appendix 4 information required for coordination and notification shall be provided at the same time as the Stage 3 Systems Review approval request under Chapter 10 of this Manual. After Stage 3 approval, the required coordination will be initiated. Notification of frequency assignments to the BR will be made after Stage 4 approval has been granted. Operational frequency assignments will not normally be granted until notification has been initiated.
4. Before Stage 2, 3, or 4 support is granted, the SSS must indicate that the appropriate Appendix 4 data have been submitted and reviewed. The SSS will review the information and:
  - a. Notify the SPS that the required data is on file.
  - b. Request the FCC Liaison Representative to submit the appropriate data to the BR or to other administrations under the provisions of the ITU Radio Regulations.
5. The submission of information to the BR concerning earth stations located outside the jurisdiction of the U.S. may be the responsibility of the country on whose territory the earth station is located.
6. As a matter of policy, advance publication information, coordination information (as necessary), and notices of frequency assignments relating to space systems shall be submitted to the BR. Exceptions to this policy will be made only by the NTIA on a case-by-case basis.

##### **3.3.1.1 Satellite Network Cost Recovery Fees**

With regard to satellite network cost recovery fees, the responsible federal agency shall submit payment of its satellite network cost recovery, in accordance with ITU Council Decision 482 currently in force, directly to the ITU upon receipt of the invoice from the BR. The responsible agency will ensure current point of contact information is supplied to the BR.

##### **3.3.1.2 Exemption Requests for Submitting Space System Information to the BR**

1. It is the practice of the U.S. not to submit space system information to the BR if: i) the intended use is for a short period of time (on the order of 12 months or less); ii) the intended use is not in accordance with the Table of Frequency Allocations of the ITU RR, or iii) national security is affected.<sup>2</sup> An agency requesting exemption from international registration for a particular satellite system shall submit a request that the international registration be waived to the SSS. The submission to the SSS shall include the following:
  - a. A statement that the agency has reviewed the existing satellite systems registered with the ITU and

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<sup>1</sup> References listed as No. “###.###” refer to ITU Radio Regulations.

determined their system is compatible;

b. A statement that the agency will continue to monitor the international registration process for satellite systems that operate co-channel to the system for which they have requested a waiver and be responsible for taking the measures necessary to ensure compatibility with any new system; and

c. A statement that the agency recognizes that should a waiver of the international registration requirement be approved and interference occurs to or from their unregistered system, they have no status or rights under the ITU Radio Regulations (RR). Agencies operating such a system, without the benefit of the recognition and protection afforded by the international registration process, assume full responsibility for making modifications required to resolve any interference problems with systems operating in accordance with the RR.

### **3.3.2 Additional Guidance and Requirements for Space Station Frequency Assignments**

#### **3.3.2.1 Administrative Due Diligence Applicable to Some Satellite Communication Services**

Resolution **49 (Rev. WRC-12)** of the Radio Regulations requires the application of an administrative due diligence procedure as from 22 November 1997 for a satellite network or satellite system of the fixed-satellite service or mobile-satellite service for which the advance publication information under No. **9.2B** has been received by the BR from 22 November 1997. Federal agencies will name the U.S. Government as the spacecraft manufacturer, launch vehicle provider, and launch vehicle.

#### **3.3.2.2 Bringing Into Use of Frequency Assignments to Geostationary Orbit (GSO) Networks**

1. Within seven years of the date of receipt of the complete advance publication information (see Nos. **9.1** or **9.2**), administrations must bring into use, notify, and provide, when applicable, due diligence information for the satellite network. The consequence for not doing so is cancellation of the satellite network filing (see No. **11.48**) and loss of all rights. Further, see No. **11.44B** for what satisfies the requirements for bringing into use a frequency assignment to a GSO network. Federal agencies shall submit a draft of the bringing into use information to the Space Systems Subcommittee at least 60 days prior to the deadline for the ITU to receive it as specified in No. **11.44B**.

2. Bringing into use a frequency assignment at multiple geostationary orbital locations with a single satellite over a short time period may be seen as inconsistent with ITU principles. When a GSO satellite that is already in orbit is used to bring into use an assignment at another orbital location, the ITU may request additional information regarding the previously notified orbital location and frequency assignments. Fleet management and satellite maneuvers should be carefully planned taking into account these factors and the 90-day minimum period. To this end, each federal agency shall be prepared to respond to such enquiries within 15 days of receipt.

#### **3.3.2.3 Satellite Failure During the 90-Day Bringing Into Use Period for GSO Networks**

In case of a satellite failure, especially that of a newly launched satellite, during the 90-day bringing into use period that renders the satellite technically incapable of operating in a given frequency band, the U.S. may submit the case to the BR for its consideration and careful investigation, taking into account all supporting materials, including details on the satellite that failed, to enable the Board to decide on the matter, as appropriate. In considering such a matter, the Board may determine whether it is appropriate to apply the provisions of No. **11.49**, on a case-by-case basis, to the relevant frequency assignments in this case.

#### **3.3.2.4 Suspension of Recorded Frequency Assignment to a Space Station**

Assignments that will be suspended for a period of time greater than 6 months, federal agencies shall submit a draft of the suspension information to the Space Systems Subcommittee at least 60 days prior to the 6-month deadline as specified in No. **11.49**.

#### **3.3.2.5 Bringing Back Into Use of Frequency Assignments to GSO Networks**

1. Federal agencies shall submit a draft of the bringing back into use information to the Space Systems

Subcommittee at least 60 days prior to the deadline for the ITU to receive it as specified in No. **11.49.1**.

2. Bringing a frequency assignment at multiple geostationary orbital locations with a single satellite over a short time period back into use may be seen as inconsistent with ITU principles. When a GSO satellite that is already in orbit is used to bring into use an assignment at another orbital location, the ITU may request additional information regarding the previously notified orbital location and frequency assignments. Fleet management and satellite maneuvers should be carefully planned taking into account these factors and the ninety-day minimum period. To this end, each federal agency shall be prepared to respond to such enquiries within 15 days of receipt.

### **3.3.2.6 Assignments Recorded Under ITU No. 11.41**

Federal agencies will notify any frequency assignments to be brought into use under No. **11.41** if coordination is incomplete. Notification under No. **11.41** invokes No. **11.42** and the requirement to cease harmful interference to any other frequency assignment that was the basis for the recording under No. **11.41**. Federal agencies shall endeavor to complete coordination in order to maximize international recognition and protection from harmful interference. Upon completing satellite network coordination with another administration or after completing coordination with a number of administrations that were the basis for recording under No. **11.41**, federal agencies shall submit updated information to be transmitted to the ITU under No. **11.41B** to the Space Systems Subcommittee.

### **3.3.2.7 Use of Frequency Assignments for a Space Station That Are Inconsistent With What is Recorded in the Master Register**

Federal agencies, working with NTIA, shall prepare a response to any queries regarding the status of frequency assignments under No. **13.6**. If the response is to a first request from the BR, the federal agencies shall submit the response to the Space Systems Subcommittee at least 15 days before the deadline specified in No. **13.6**. If the response is to a second or third request from the BR, then the federal agencies shall submit the response to the Space Systems Subcommittee at least 7 days before the deadline.

### **3.3.3 Provision of Information Regarding Terrestrial Systems**

Any federal agency intending to register a terrestrial station assignment with the ITU Radiocommunication Bureau (BR) shall provide the coordination information, if necessary, and notification information, as contained in Appendix 4 to the ITU Radio Regulations, to the Federal Communications Commission (Notification Branch, Planning and Negotiations Division, International Bureau) for submission to the BR.

## **3.4 AGREEMENT BETWEEN THE UNITED STATES OF AMERICA AND CANADA CONCERNING THE COORDINATION AND USE OF RADIO FREQUENCIES ABOVE 30 MEGACYCLES PER SECOND**

### **3.4.1 General**

The U.S.-Canada Agreement relating to the Coordination and Use of Radio Frequencies Above 30 Megacycles per Second contains a Technical Annex which is composed of an index and seven frequency sharing/coordination arrangements lettered A, B, C, D, E, F, and G, respectively.

The Index to the Technical Annex indicates for each of the seven arrangements the frequency bands involved and the authorized coordination agencies or channels in each country for each band.

The NTIA and Industry Canada (The Canadian Department of Industry, known as Industry Canada, has superseded the Department of Communications which had previously superseded the Department of Transport as the authorized coordination agency or channel for Canada with respect to certain frequency bands.) are the authorized coordination agencies for the bands shown in the following tabulation:

<b>Band (MHz)</b>	<b>Arrangement</b>	<b>Type Assignments Involved</b>
32.0-33.0	D	Experimental and military tactical & training excluded
34.0-35.0	D	Same as above
36.0-37.0	D	Same as above



38.0-39.0	D	Same as above
40.0-42.0	D	Same as above
46.6-47.0	ITU RR 228	Ionospheric scatter only
49.6-50.0	ITU RR 228	Same as above
138.0-144.0	D	Experimental and military radar and tactical & training excluded
148.0-149.9	D	Same as above
150.05-150.8	D	Same as above
162.0-174.0	D	Experimental and military tactical & training excluded
406.1-430.0	E	Same as above
1540.0-1660.0	B	Space techniques only
1710.0-1850.0	D	Experimental and military tactical & training excluded
2110.0-2120.0	D	Experimental excluded
2200.0-2290.0	D	Experimental and military tactical & training excluded
2900.0-3100.0	C	Non-military radar only
4200.0-4400.0	B	Space techniques only
4400.0-4990.0	D	Experimental and military tactical & training excluded
5000.0-5250.0	B	Space techniques only
5460.0-5650.0	C	Non-military radar only
7125.0-7250.0	D	Experimental and military tactical & training excluded
7250.0-7750.0	D	Experimental excluded
7750.0-7900.0	D	Experimental and military tactical & training excluded
7900.0-8400.0	D	Experimental excluded
9300.0-9500.0	C	Non-military radar only
15400.0-15700.0	B	Space techniques only

### 3.4.2 Index to the Technical Annex

*(The Index to the Technical Annex, Arrangements C and D, and the pertinent portion of Arrangement B are reproduced below.)*

Item	Frequency	Authorized Coordination Agencies or Channels		Coordination Arrangements Remarks
		US	Canada	
1	30.56-32.0	FCC	DOT	Arrangement A
2	32.0-33.0	IRAC	DOT	Arrangement D
3	33.0-34.0	FCC	DOT	Arrangement A
4	34.0-35.0	IRAC	DOT	Arrangement D
5	35.0-36.0	FCC	DOT	Arrangement A
6	36.0-37.0	IRAC	DOT	Arrangement D
7	37.0-38.0	FCC	DOT	Arrangement A
8	38.0-39.0	IRAC	DOT	Arrangement D
9	39.0-40.0	FCC	DOT	Arrangement A
10	40.0-42.0	IRAC	DOT	Arrangement D
11	42.0-46.6	FCC	DOT	Arrangement A
12	46.6-47.0	IRAC	DOT	ITU RR 228
13	47.0-49.6	FCC	DOT	Arrangement A
14	49.6-50.0	IRAC	DOT	ITU RR 228
15	72.0-73.0	FCC	DOT	Arrangement A
16	74.6-75.4	FAA	DOT	Arrangement B

17	75.4-76.0	FCC	DOT	Arrangement A
18	108.0-117.975	FAA	DOT	Arrangement B
19	117.975-121.975	FAA	DOT	Arrangement B
20	121.975-123.075	FCC	DOT	Arrangement B
21	123.075-123.575	FCC	DOT	Arrangement B
22	123.575-128.825	FAA	DOT	Arrangement B
23	128.825-132.025	FCC	DOT	Arrangement B
24	132.025-136.0	FAA	DOT	Arrangement B
25	138.0-144.0	JCS	CDS*	Arrangement C
26	148.0-149.9	IRAC	DOT	Arrangement D
27	148.0-149.9	JCS	CDS	Arrangement C
28	150.05-150.8	IRAC	DOT	Arrangement D
29	150.05-150.8	JCS	CDS*	Arrangement C
30	150.8-174.0	FCC	DOT	Arrangement A
31	162.0-174	IRAC	DOT	Arrangement D
32	216.0-225.0	JCS	CDS*	Arrangement C
33	328.6-335.4	FAA	DOT	Arrangement B
33bis	406.1-430.0	NTIA	DOC	Arrangement E
34	420.0-450.0	JCS	CDS*	Arrangement C
35	450.0-470.0	FCC	DOT	Arrangement A
35bis	764-776	FCC	IC	Arrangement G
35ter	794-806	FCC	IC	Arrangement G
35quar	806-890	FCC	DOC	Arrangement F
36	890.0-942.0	JCS	CDS*	Arrangement C
37	942.0-960.0	FCC	DOT	Arrangement A
38	960.0-1215.0	FAA	DOT	Arrangement B
39	1215.0-1400.0	JCS	CDS*	Arrangement C
40	1300.0-1350.0	FAA	DOT	Arrangement C
41	1535.0-1540.0			Coordination not required at this time
42	1540.0-1660.0	IRAC	DOT	Arrangement B
43	1710.0-1850.0	IRAC	DOT	Arrangement D
44	1850.0-2200.0	FCC	DOT	Arrangement A
45	2110.0-2120.0	IRAC	DOT	Arrangement D
46	2200.0-2290.0	IRAC	DOT	Arrangement D
47	2300.0-2450.0	JCS	CDS*	Arrangement C
48	2450.0-2690.0	FCC	DOT	Arrangement A
49	2700.0-2900.0	FAA	DOT	Arrangement C
50	2700-3700.0	JCS	CDS*	Arrangement C
51	2900-3100.0	IRAC	DOT	Arrangement C
52	3700.0-4200.0	FCC	DOT	Arrangement A
53	4200.0-4400.0	IRAC	DOT	Arrangement B
54	4400.0-4990.0	IRAC	DOT	Arrangement D
55	5000.0-5250.0	IRAC	DOT	Arrangement B
56	5250.0-5925.0	JCS	CDS*	Arrangement C
57	5460.0-5650.0	IRAC	DOT	Arrangement C
58	5925.0-7125.0	FCC	DOT	Arrangement A
59	7125.0-8400.0	IRAC	DOT	Arrangement D
60	8400.0-8500.0			Coordination not required at this time
61	8500.0-10500.0	JCS	CDS*	Arrangement C
62	9000.0-9200.0	FAA	DOT	Arrangement C
63	9300.0-9500.0	IRAC	DOT	Arrangement C
64	10.55-10.68 GHz	FCC	DOT	Arrangement A

65	10.70-13.25 GHz	FCC	DOT	Arrangement A
66	13.25-13.4 GHz			Coordination not required at this time
67	13.4-14.0 GHz	JCS	CDS*	Arrangement C
68	14.0-15.4 GHz			Coordination not required at this time
69	15.4-15.7 GHz	IRAC	DOT	Arrangement B
70	15.7-17.7 GHz	JCS	CDS*	Arrangement C
71	17.7-23.0 GHz			Coordination not required at this time
72	23.0-24.25 GHz	JCS	CDS*	Arrangement C
73	24.25-33.4 GHz			Coordination not required at this time
74	33.4-36.0 GHz	JCS	CDS*	Arrangement C
75	36.0 GHz and above			Coordination not required at this time

\*CDS - Chief of Defense Staff - Authorized Coordination Channel only. Coordination of Frequency Assignments in the 138-144 MHz Band

Without amendment of the agreement, the IRAC and the Canadian Department of Communications agreed to coordinate fixed and mobile service (excluding tactical and training) assignments in the band 138-144 MHz in accordance with the provisions of Arrangement D of the Agreement (Ref. IRAC Doc. 20638/1).

### 3.4.3 No. 228 of the ITU Radio Regulations

No. 228, as well as other provisions of the Radio Regulations relating to ionospheric scatter assignments, was not carried over from the World Administrative Radio Conference (Geneva, 1979). References to No. 228 in the Agreement are no longer valid and remain in Sections 3.4.1 and 3.4.2 of the Manual pending renegotiation of the Agreement, including Arrangement D, with the Government of Canada.

### 3.4.4 Text of Arrangement B

Arrangement For the Exchange of Frequency Assignment Information and Engineering Comments on Proposed Assignments Along the Canada/U.S. Borders in Certain Aviation Bands.

(Adopted Ottawa, March 1962; Revised Washington, D.C., October 1964)

(1) This arrangement involves assignments in the frequency bands set forth in paragraph 8 hereof.

(2) In the interest of the planned use of the spectrum, information concerning future expansions and adjustments of the services allocated these bands, in the coordination zones stipulated in the Appendices attached hereto, shall be exchanged to the maximum extent practicable.

(3) The Agency proposing to establish a new station, or to modify the basic characteristics of an existing station, shall furnish to the appropriate Agency the technical data necessary to complete coordination, in accordance with the attached Appendices.

(4) The Agency responsible for coordination shall examine the information provided and shall reply as soon as practicable advising whether or not a conflict is anticipated. If so, the detail of the conflict and the particulars of the station likely to experience interference shall be supplied. New proposals or discussions may be initiated with the object of resolving the problem.

(5) In the interest of planned use of the frequency bands allocated for use of space techniques in the Aeronautical Mobile (R) and Aeronautical Radionavigation Services, information concerning assignments to stations using space techniques in these bands shall be exchanged to the maximum extent practicable. This will involve assignments for a) all spacecraft and b) transmitting stations and receiving stations which use space techniques.

(6) Whenever differences of opinion concerning the probability of harmful interference exist, which cannot be resolved otherwise, or in cases where the information available makes it difficult to determine whether harmful interference would be created by the proposed operation, mutual arrangement should be made for actual on-the-air tests to be observed by representatives of the U.S. agencies concerned and the Department of Transport. Should harmful interference be caused to the existing station, the Agency having jurisdiction over the proposed operation should be notified promptly so that the transmissions of the interfering station may be halted.

(7) Neither the U.S. agencies concerned nor the Department of Transport shall be bound to act in accordance with the views of the other. However, to keep such instances to a minimum, each Agency should cooperate to the

fullest extent practicable with the other by furnishing such additional data as may be required.

(8) The bands treated and the agreed action on each are as follows:

Frequency Band Mc/s	Authorized Coordination Agency		Remarks
	U.S.	Canada	
74.60-75.40	FAA	DOT	Coordination not required at this time
108.0-117.975	FAA	DOT	SEE APPENDIX 1
117.975-121.975	FAA	DOT	SEE APPENDIX 2
121.975-123.075	FCC	DOT	Coordination not required at this time
123.075-123.575	FCC	DOT	Coordination not required at this time
123.575-128.825	FAA	DOT	SEE APPENDIX 2
128.825-132.025	FCC	DOT	SEE APPENDIX 3
132.025-135.0	FAA	DOT	SEE APPENDIX 2
135.0-136.0	FAA	DOT	SEE APPENDIX 4
328.6-335.4	FAA	DOT	SEE APPENDIX 1
960.0-1215.0	FAA	DOT	SEE APPENDIX 1
1540-1660	IRAC	DOT	Coordination not required at this time except for applications involving the use of space techniques
4200-4400	IRAC	DOT	Coordination not required at this time except for applications involving the use of space techniques
5000-5250	IRAC	DOT	Coordination not required at this time except for applications involving the use of space techniques
15.4-15.7 Gc/s	IRAC	DOT	Coordination not required at this time except for applications involving the use of space techniques

NOTE: "Coordination not required at this time" in the Remarks column indicates that the present use of these frequencies does not cause conflict in their application, either in the U.S. or Canada. However, authorized agencies are designated to coordinate any future use, which may be capable of causing harmful interference. (Appendices 1 through 4 of Arrangement B are not reproduced in this Manual.)

### 3.4.5 Text of Arrangement C

#### Arrangement for Frequency Coordination of Fixed Installation Radars

(Adopted Ottawa, March 1962, and revised Washington, D.C., October 1964)

It is agreed that:

(1) Coordination shall be effected in those frequency bands used by fixed installation radars, some of which are essential to the defense of North America, whenever there is considered to be a likelihood of harmful interference. For this purpose information will be exchanged through the authorized coordination agencies, as follows:

- (a) All relevant existing assignments as of the effective date of this arrangement, as soon as practicable.
- (b) Current editions of the information in (a), as requested.
- (c) Proposed or planned assignments as far in advance as practicable.

(2) The authorized agencies responsible for taking action on the coordinations are specified in the Index to the Technical Annex. In the case of U.S. military coordinations, the coordination data will be transmitted via the established coordination channel. The Canadian military will coordinate as necessary with the DOT who will be responsible for the technical examination and completion of Canadian coordination in conjunction with cognizant Canadian military agencies. In the case of Canadian originated military coordinations, after internal coordination with the DOT, the data will be passed to the U.S. via the established coordination channel. Non-military coordinations, after complete internal coordination, will be transmitted direct between the authorized non-military coordination agencies shown in the Index for each particular band.

(3) Detailed characteristics of transmitting and receiving equipment, for both radar and any relevant non-radar equipment, will be exchanged in advance of the coordination referred to above. The minimum desirable information is as follows:

- (a) Frequency band or operating frequencies
- (b) Location name and geographical coordinates
- (c) Site elevation above mean sea level and antenna height above ground

- (d) Class of emission and necessary bandwidth
- (e) Power (peak) delivered to the antenna
- (f) Function
- (g) Antenna gain and orientation

(4) Until the bands covered by this arrangement have been cleared of potential conflicts, at installations where there is a possibility of harmful interference, evaluation testing of radar installations will be carried out at the time of activation and maximum cooperation will be extended in obtaining the best engineering solution to any harmful interference problems. It is recognized that special problems exist in bands presently in use for non-radar purposes. These problems require continuous further study as regards both the procedures and the necessity of allocation adjustments so as to accommodate radars essential to the defense of North America.

(5) Radar assignments in use on the effective date of this arrangement are not subject to further coordination by virtue of this arrangement.

(6) Mobile radar assignments are not subject to this arrangement.

NOTE: For the purpose of complying with the provisions of paragraph 1 of Arrangement C, the IRAC shall coordinate all proposed non-military assignments to stations, other than mobile stations, with a power of one kilowatt peak or over, which are located within the coordination zone specified in paragraph 2(a) of Arrangement D.)

### 3.4.6 Text of Arrangement D

Arrangement Between the Department of Transport and the Interdepartment Radio Advisory Committee For the Exchange of Frequency Assignment Information and Engineering Comments on Proposed Assignments Along the Canada-United States Borders in Certain Frequency Bands Above 30 Mc/s.

(Adopted Washington, D.C., June 1956; Revised Ottawa, March 1962 and Washington, D.C., October 1964).

1. This arrangement provides for the exchange of frequency assignment information and engineering comments on proposed assignments in the following frequency bands:

(a) Mc/s	32.00-33.00	40.00-42.00	1710.00-1850.00	(b) Mc/s	2110.00-2120.00
	34.00-35.00	148.00-149.90	2200.00-2290.00		7250.00-7750.00
	36.00-37.00	150.05-150.80	4400.00-4990.00		7900.00-8400.00
	38.00-39.00	162.00-174.00	7125.00-7250.00		
			7750.00-7900.00		

2. (a) For the bands below 1000 MHz, the areas involved are those bounded by:

Line A-Begins at Aberdeen, Wash. running by great circle arc to the intersection of 48°N., 120°W., thence along parallel 48°N., to the intersection of 95°W., thence by great circle arc through the southernmost point of Duluth, Minn., thence by great circle arc to 45°N., 85°W., thence southward along meridian 85°W., to its intersection with parallel 41°N., thence along parallel 41°N., to its intersection with meridian 82°W., thence by great circle arc through the southernmost point of Bangor, ME, thence by great circle arc through the southernmost point of Searsport, ME, at which point it terminates; and

Line B-Begins at Tofino, B.C., running by great circle arc to the intersection of 50°N, 125°W, thence along parallel 50°N., to the intersection of 90°W., thence by great circle arc to the intersection of 45°N., 79°30'W, thence by great circle arc through the northernmost point of Drummondville, Quebec (Lat: 45°52'N., Long: 72°30'W.), thence by great circle arc to 48°30'N, 70°W., thence by great circle arc through the northernmost point of Campbellton, N.B., thence by great circle arc through the northernmost point of Liverpool, N.S., at which point it terminates. Line C-Begins at the intersection of 70°N., 144°W., thence by great circle arc to the intersection of 60°N., 143°W., thence by great circle arc so as to include all of the Alaskan Panhandle; and

Line D-Begins at the intersection of 70°N., 138°W., thence by great circle arc to the intersection of 61°20'N., 139°W. (Burwash Landing), thence by great circle arc to the intersection of 60° 45'N., 135°W., thence by great circle arc to the intersection of 56°N., 128°W., thence south along 128° meridian to Lat. 55°N., thence by great circle arc to the intersection of 54°N., 130°W., thence by great circle arc to Port Clements, thence to the Pacific Ocean where it ends.

(b) For any station of a terrestrial service using a band above 1000 MHz, the areas involved are as follows:

- (1) For a station the antenna of which looks within the 200° sector toward the Canada-United States borders, that area in each country within 35 miles of the borders;
- (2) For a station the antenna of which looks within the 160° sector away from the Canada-United States borders, that area in each country within 5 miles of the borders; and,
- (3) The area in either country within the coordination distance (paragraph 8) of a receiving earth station in the other country which uses the same band.

(c) For the bands above 1000 MHz, coordination of an earth station is required if any portion of the Canada-United States borders lies within the coordination distance (paragraph 8) of the earth station.

3. Current records of frequency assignments in the frequency bands listed in paragraph 1 will be exchanged as required.

4. (a) Before either Agency takes final action on any proposal for the use of any frequency, other than for military tactical and training operations in the bands listed in paragraph (1)(a), in the areas stipulated in paragraph (2):

- (1) in the bands below 1000 MHz, listed in paragraph (1) involving power in excess of 5 watts; or,
- (2) in the bands above 1000 MHz, listed in paragraph (1);

it will refer the pertinent particulars of the proposed assignment (see Appendix 1, 2 or 3, as appropriate) to the other Agency for comment on whether the granting of an authorization will be liable to result in the causing of harmful interference to any existing radio operations of the Agency whose views are sought, or, in the case of a receiving earth station, whether harmful interference would be caused to reception at the earth station by any existing radio operations of the Agency whose views are sought.

(b) If adverse comment is not received within 30 calendar days from the date of the receipt of the proposal, the initiating Agency may go ahead with the operation after having notified the other Agency. In an emergency, coordination may be effected after the assignment is put into operation.

(c) Neither the Interdepartment Radio Advisory Committee nor the Department of Transport shall be bound to act in accordance with the views of the other. However, to keep such instances to a minimum, each Agency should cooperate to the fullest extent practicable with the other by furnishing such additional data as may be required.

5. In cases where the information available makes it difficult to determine whether harmful interference would be created by the granting of a particular authorization, arrangements may be made for actual on-the-air tests to be observed by representatives of each Agency and further exchanges of engineering comments following such tests.

6. In the interest of planned use of the spectrum, information about future expansions and adjustments of the services allocated the use of the bands listed in paragraph (1), in the areas stipulated herein, may be exchanged to the maximum extent practicable.

7. Where a previously coordinated frequency assignment is in use and an additional assignment is proposed for the same frequency in the same area, the additional assignment must also be coordinated, attention being drawn to the previous coordination. This does not apply to the addition of mobile units to a previously coordinated land mobile system.

8. Coordination distance shall be the distance, calculated for any station, according to Recommendation 1A of the Final Acts of the EARC, Geneva, 1963.

## **APPENDIX 1 TO ARRANGEMENT D**

Basic Data Required for the Coordination of Terrestrial Stations in the Bands Below 1000 MHz

- a. Class of station
- b. Number of stations (including, when available, number of mobile stations)
- c. Location and coordinates
- d. Frequency
- e. Power (mean) delivered to the antenna. Class of emission and necessary bandwidth
- f. Antenna gain (dB) and azimuth, when available
- g. Antenna elevation in feet above mean sea level (MSL), when available

## **APPENDIX 2 TO ARRANGEMENT D**

Basic Data Required for the Coordination of Terrestrial Stations in the Bands Above 1000 MHz

- a. Class of station
- b. Number of stations (including, when available, number of mobile stations)
- c. Location and coordinates
- d. Frequency
- e. Power (mean) delivered to the antenna
- f. Class of emission and necessary bandwidth
- g. Antenna gain (dB), azimuth and, when available, elevation angle
- h. Antenna elevation in feet above mean sea level (MSL)
- i. Polarization of transmitted wave
- j. Topographic map of territory between stations at fixed locations and the Canada-United States borders (required only for stations within the coordination distance of a previously coordinated receiving station which uses the same band)

## APPENDIX 3 TO ARRANGEMENT D

### Basic Data Required for the Coordination of Earth Stations in the Space Service

- a. Class of station
- b. Frequencies
- c. Location and coordinates
- d. Azimuthal and elevation coverage of celestial hemisphere as defined by main axis of antenna
- e. Class of emission and necessary bandwidth
- f. Power (mean) delivered to the antenna and, where applicable, estimated terminal coupling losses
- g. Maximum gain of antenna in the horizontal plane as a function of azimuth
- h. Maximum gain of antenna (referred to isotropic)
- i. Antenna elevation in feet above mean sea level (MSL)
- j. Polarization of transmitted wave
- k. Topographic map of territory between earth station and Canada-United States borders in the sector wherein the coordination distance exceeds the distance to the border
- l. Numerical values of terrain shielding in the pertinent directions

### 3.4.7 Determination of the Coordination Area Around an Earth Station

With respect to paragraph 8 of Arrangement D, Recommendation 1A of the Final Acts of the Extraordinary Administrative Radio Conference (Geneva, 1963) has been superceded. The method for determination of the coordination area around an earth station in the frequency bands between 100 MHz and 105 GHz shall now be in accordance with Appendix 7 (**Rev.WRC-03**) of the ITU Radio Regulations.

### 3.4.8 Text of Arrangement E

Arrangement Between the Department of Communications of Canada and the National Telecommunications and Information Administration and the Federal Communications Commission of the United States Concerning the Use of the 406.1 MHz to 430 MHz Band in Canada-United States Border Areas

#### *1. General*

**1.1**-This Arrangement between the Department of Communications of Canada and the National Telecommunications and Information Administration and the Federal Communications Commission of the United States, herein referred to as the Agencies, provides for the operation of Canadian Fixed and Mobile Services and United States Fixed and Mobile Services in the 406.1-430 MHz band and United States Radiolocation Service in the 420-430 MHz band. In accordance with the international Table of Frequency Allocations contained in the Final Acts of the World Administrative Radio Conference (Geneva, 1979), aeronautical mobile radio services are excluded from the band 406.1 to 430 MHz.

**1.2**-Section 6 of this Arrangement sets forth the conditions for the shared use of the 420-430 MHz band by the Fixed and Mobile Services in Canada (the Mobile Service being primary and Fixed Service being secondary in Canada) and the Radiolocation Service in the United States (the Radiolocation Service being primary in the United States).

**1.3-**The areas involved in this Arrangement concerning sharing by the Canadian and United States Fixed and Mobile Services are those set forth in sub-paragraph 2(a) of Arrangement D of this Agreement; hereafter these areas are referred to in this Arrangement as the Coordination Zone.

**1.4-**For the purpose of coordinating assignments to stations in the Fixed and Mobile Services in the 406.1-430 MHz band with 25 kHz spacing between channels and 16 kHz necessary bandwidth, a minimum interstitial channel (12.5 kHz offset) selectivity of 25 dB will be assumed. The standard definition and method of measurement is defined in the United States Electronic Industries Association (EIA) specification RS-204B, titled "Adjacent Channel Selectivity and Desensitization", dated April 1980.

**1.5-**The coordination channel for this Arrangement is the Department of Communications in Canada and the National Telecommunications and Information Administration in the United States, in accordance with the procedures of Arrangement D of this Agreement.

## **2. Exceptions**

**2.1-**It is recognized that in the band 406.1-420 MHz there are limited requirements for airborne operations. When the possibility exists that assignments outside of the normal Coordination Zone might result in harmful interference to the radio services of the other country due to their particular circumstances, i.e., aircraft altitude, power, etc., the assignment of the frequencies involved will, to the extent practicable, be subject to special coordination between the National Telecommunications and Information Administration and the Department of Communications.

**2.2-**The Amateur Service is excluded from the band 420-430 MHz in the Coordination Zone. Additionally, airborne operations associated with stations in the Fixed and Mobile Services are excluded from this band.

**2.3-**Stations in the Fixed and Mobile Services will not operate in the 420-430 MHz band within 250 km of the United States-Canada border in the state of Alaska or the Yukon Territory.

## **3. The Use of the 406.1-420 MHz Band by the Fixed and Mobile Services**

**3.1-**Proposed frequency assignments in this band are subject to coordination between Industry Canada and the National Telecommunications and Information Administration in accordance with the procedures of Arrangement D of this Agreement.

**3.2-**Except for the bands identified in paragraph 3.6, the frequencies identified in paragraph 3.7 and the band identified in paragraph 3.9, all existing frequency assignments in the two countries which are included in the lists appended to this Arrangement as Annex A (Canada) and Annex B <sup>2</sup>(United States) are accepted as coordinated by the Department of Communications and the National Telecommunications and Information Administration and have equal status under this Agreement.

**3.3-**The United States will channel and use the band for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart, from 406.125 to 419.975 MHz inclusive. Canada will channel and use the band for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart from 406.1125 to 419.9875 MHz inclusive.

**3.4-**The use of a necessary bandwidth greater than 16 kHz is discouraged but is permitted as an exception subject to coordination on a case by case basis in accordance with the procedures specified in Arrangement D of this Agreement.

**3.5-**Canada, within its Coordination Zone, agrees to protect the existing and future unrestricted geographic use in the United States of the bands 406.1875-406.4625 and 408.6875-408.9625 MHz. Coordination with Canada of assignments in the United States in these bands is not required.

**3.6-**Use of the bands 406.1875-406.4625 and 408.6875-408.9625 MHz by Canada within its Coordination Zone is to be coordinated on a case by case basis and must meet the terms of 3.5 above. It is understood that any such Canadian use of these bands will only be attempted as a last resort when a requirement cannot be met outside these bands. Any such coordinated radio system must be adjusted or removed if it causes interference to existing United States radio systems or is anticipated to cause interference to planned United States radio systems.

**3.7-**Canada, within its Coordination Zone, agrees to protect the existing and future unrestricted geographic use in the United States of the following center frequencies with 16 kHz or less necessary bandwidth (all MHz):

415.850	416.000	418.475
415.875	416.025	418.500
415.900	418.375	418.525

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<sup>2</sup> Not printed herein. The annex is deposited in the archives of the Department of State where it is available for reference.



415.925	418.400	418.550
415.950	418.425	418.600
415.975	418.450	

Coordination with Canada of assignments in the United States on these frequencies is not required.

**3.8-**Canadian use of the above listed center frequencies within its Coordination Zone is to be coordinated on a case by case basis and must meet the terms of 3.7 above. It is understood that any such Canadian use of these frequencies will only be attempted as a last resort when a requirement cannot be met on other frequencies. Any such coordinated radio system must be adjusted or removed if it causes interference to existing United States radio systems or is anticipated to cause interference to planned United States radio systems.

**3.9-**With the exception of United States use of the frequency 409.625 MHz, the United States, within its Coordination Zone, agrees to protect the existing and future unrestricted geographic use in Canada of the band 409-410 MHz. Canadian use of the 409-410 MHz band is primarily for mobile stations paired with base stations in the 420-421 MHz band. Coordination with the United States of assignments in Canada in this band is not required. The protection of the existing and future unrestricted geographic use of the frequency 409.625 MHz in the United States is based on 16 kHz necessary bandwidth.

**3.10-**With the exception of the United States use of the frequency 409.625 MHz, other use of the 409-410 MHz band by the United States within its Coordination Zone is to be coordinated on a case by case basis and must meet the terms of 3.9 above. It is understood that any such United States use of the 409-410 MHz band within its Coordination Zone will only be attempted as a last resort when a requirement cannot be met outside the band. Any such coordinated radio system must be adjusted or removed if it causes interference to existing Canadian radio systems or is anticipated to cause interference to planned radio systems.

**3.11-**It is recognized that Canada and the United States have unrestricted geographic use of the bands and/or frequencies specified in 3.5, 3.7 and 3.9. When the possibility exists that assignments outside the Coordination Zone may result in harmful interference to the radio services of the other country, due to the particular characteristics of such assignments (e.g., antenna height, power, directive arrays, etc.), special coordination may be initiated by that Agency which does not have the unrestricted geographic use.

#### *4. The Use of the 420-421 MHz Band by the Fixed and Mobile Services*

**4.1-**The United States, within its Coordination Zone, agrees to protect the existing and future unrestricted geographic use in Canada of the band 420-421 MHz from Fixed and Mobile Services. Canadian use of the 420-421 MHz band is primarily for base stations paired with mobile stations in the 409-410 MHz band. Coordination with the United States of assignments in Canada in this band is not required, except as specified in 6.3.

**4.2-**United States use of the 420-421 MHz band within its Coordination Zone is to be coordinated on a case by case basis and must meet the terms of 4.1 above. It is understood that any such United States use of 420-421 MHz within its Coordination Zone will only be attempted as a last resort when a requirement cannot be met outside the band. Any such coordinated radio system must be adjusted or removed if it causes interference to existing Canadian radio systems or is anticipated to cause interference to planned radio systems.

**4.3-**It is recognized that Canada has unrestricted geographic use in Canada of the band 420-421 MHz, except as specified in Section 6. When the possibility exists that assignments in the Fixed and Mobile Services outside of the Coordination Zone in the United States might result in harmful interference to the radio services in Canada, due to the particular characteristics of the U.S. assignments (e.g., antenna height, power, directive arrays, etc.), the U.S. Agency may effect special coordination of the frequencies involved.

#### *5. The Use of the 421-430 MHz Band by the Fixed and Mobile Services*

**5.1-**Sharing of this band is carried out by the Agencies within the terms and conditions specified in this section. Figures 1, 2 and 3 represent the text of this section in chart and map form.

**5.2-**The 421.000-424.9875 MHz and 426.000-429.9875 MHz bands will be used for Fixed and Mobile Services systems which will operate on frequency pairs: one frequency from each band. Mobile systems will operate with the mobile receivers on the lower band and mobile transmitters on the upper band. The 424.9875-426.000 MHz band will also be utilized for Fixed and Mobile Service systems.

**5.3-**Except as provided in Paragraph 5.4 and Section 6, the 421-430 MHz band will be shared between the two countries as follows: a) Canada will have unrestricted geographic use of the bands 421.000-423.000 MHz and 425.500-428.000 MHz. b) The United States will have unrestricted geographic use of the bands 423.0125-425.4875 MHz and 428.0125-429.9875 MHz.

**5.4-**In recognition of demographic circumstances, the division of spectrum between Canada and the United States varies from the general sharing provisions of Paragraph 5.3 in the two sectors defined below:

- a) Sector I is defined to be the portions of the Coordination Zone in the United States and Canada, bounded

on the west by 85°W longitude and on the east by 81°W longitude. In this sector of the Coordination Zone, the United States will have the unrestricted geographic use of the bands 422.1875-425.4875 MHz and 427.1875-429.9875 MHz; Canada will have the unrestricted geographic use of the bands 421.000-422.175 MHz, and 425.500-427.175 MHz.

b) Sector II is defined to be the portions of the Coordination Zone in the United States and Canada bounded on the west by 81°W longitude and on the east by 71°W longitude. In this sector of the Coordination Zone, the United States will have the unrestricted geographic use of the bands 423.8125-425.4875 MHz and 428.8125-429.9875 MHz; Canada will have the unrestricted geographic use of the bands 421.000-423.800 MHz and 425.500-428.800 MHz.

**5.5-**As a result of the special sharing arrangements of Paragraph 5.4, the overlap of frequency bands occurs in the following geographical areas:

**5.5.1-**The geographical area in Canada is enclosed by the United States-Canada border; the meridian 71°W; and the line beginning at the intersection of 72°20'W and the United States-Canada border, thence running north along the meridian 72°20'W to the intersection of 46°N, thence running east along 46°N to the meridian 71°W. Canada will channel and use the 423.0125-423.800 MHz and 428.0125-428.800 MHz bands for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart from 423.0375 to 423.7875 MHz inclusive and 428.0375 to 428.7875 MHz inclusive.

The geographical area in the United States is enclosed by the United States-Canada border; the meridian 71°W; and the line beginning at the intersection of 44°13'N, 71°W, running by great circle arc to the intersection of 45°N and 69°40'W, thence north along the meridian 69°40'W, to the intersection of 46°N, thence running west along 46°N to the intersection of the United States-Canada border. The United States will channel and use the 423.0125-423.800 MHz and 428.0125-428.000 MHz bands for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart from 423.025 to 423.775 MHz inclusive and 428.025 to 428.775 MHz inclusive.

Coordination of proposed frequency assignments in the bands 423.0125-423.800 MHz and 428.0125-428.800 MHz is required in two areas as follows:

(a) The geographical area in Canada is enclosed by the United States-Canada border; the meridian 71°W; and the line beginning at the intersection of 72°W and the United States-Canada border, thence running north along meridian 72°W to the intersection of 45°45'N, thence running along 45°45'N to the meridian 71°W.

(b) The geographical area in the United States is enclosed by the United States-Canada border; the meridian 71°W and the line beginning at the intersection of 44°25'N and 71°W, thence running by great circle arc to the intersection of 45°N and 70°W, thence north along meridian 70°W to the intersection of 45°45'N, thence running west along 45°45'N to the intersection of the United States-Canada border.

**5.5.2-**Within the land area in the United States enclosed by the line of 81°W longitude, the arc of a circle of 120 km radius centered at the intersection of 81°W longitude and the northern shore of Lake Erie and drawn clockwise from the southerly intersection with 81°W longitude to the westerly intersection with the United States-Canada border, and the United States-Canada border, the United States will channel and use the bands 422.1875-423.800 MHz and 427.1875-428.800 MHz for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart from 422.200 to 423.775 MHz inclusive and 427.200 to 428.775 MHz inclusive.

Within the land area in Canada enclosed by the line of 81°W longitude, the arc of a circle of 120 km radius centered at the intersection of 81°W longitude and the southern shore of Lake Erie drawn clockwise from the northerly intersection with 81°W longitude to the easterly intersection with the United States-Canada border, and the United States-Canada border, Canada will channel and use the bands 422.1875-423.800 MHz and 427.1875-428.800 MHz for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart from 422.2125 to 423.7875 MHz inclusive and 427.2125 to 428.7875 MHz inclusive.

**5.5.3-**Within the land area in the United States enclosed by the line of 85°W longitude, the arc of a circle of 120 km radius centered at the intersection of 85°W longitude and the Ontario-Lake Superior shore, and drawn counter-clockwise from the southerly intersection with 85°W longitude to the easterly intersection with the United States-Canada border, and the United States-Canada border, the United States will channel and use the bands 422.1875-423.000 MHz and 427.1875-428.800 MHz for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart from 422.200 to 422.975 MHz and 427.200 to 427.975 MHz inclusive.

Within the land area in Canada enclosed by the line of 85°W longitude, the arc of a circle of 120 km radius centered at the intersection of 85°W longitude and Michigan-Lake Superior shore, drawn counter-clockwise from the northerly intersection with 85°W longitude to the westerly intersection with the United States-Canada border, and the United States-Canada border, Canada will channel and use the bands 422.1875-423.000 MHz and 427.1875-

428.000 MHz for assignments with 16 kHz or less necessary bandwidth on center frequencies spaced 25 kHz apart from 422.2125 to 422.9875 MHz inclusive and 427.2125 to 427.9875 MHz inclusive.

**5.6-**In order to minimize the need for coordination in the band 421-430 MHz, Effective Radiated Power (ERP) and Effective Antenna Height (EAH) guidelines have been established as provided in Annex C. If these ERP values are exceeded, within the corresponding EAH ranges, coordination is required in accordance with the procedures specified in Arrangement D of this Agreement.

*6. Conditions for the Shared Use of the 420-430 MHz Band by the Canadian Fixed and Mobile Services with the United States Radiolocation Service*

**6.1-**Existing United States fixed installation radars, with exception of the installation at Concrete, N.D. and those in Alaska, which will receive or cause harmful interference from or to fixed and mobile operations in Canadian territory, will restrict their operational use to the 430-450 MHz band except during emergency periods when the United States reserves the right to operate all radiolocation devices on an unrestricted basis. The United States radar at Concrete, N.D. and Canadian fixed and mobile systems in the adjacent border area will be protected from interference by observation in Canada of fixed and mobile system power and height restrictions.

No use of this band by the Fixed and Mobile Services will be allowed to advertently impact the operation of the radar at Concrete, N.D. If the United States reports harmful interferences to its radar at Concrete, N.D., which is caused by fixed or mobile operations in Canada, Canada will cooperate in the immediate identification and elimination of such harmful interference. Subsequently the United States will cooperate to attempt to reach a mutually satisfactory resolution of the problem.

**6.2-**The United States reserves the right, irrespective of other provisions of this Arrangement, to operate in the band 420-430 MHz radiolocation stations on board fixed wing aircraft. However, the United States will minimize use of this band on flights when they are within possible interference range of fixed and mobile operations in major Canadian population areas. If Canada reports harmful interference to Canadian fixed or mobile operations which is caused by radiolocation transmission from United States fixed wing aircraft, the United States will cooperate in resolution of such harmful interference to the maximum extent possible.

**6.3-**Proposed assignments for Canadian fixed and mobile systems which are not in accordance with the constraints specified for mutual compatibility with the radar at Concrete, N.D. and with radars aboard U.S. ships transiting the Strait of Juan de Fuca and Puget Sound and any other proposed assignment whose compatibility with these radiolocation units is in doubt, will be coordinated with the National Telecommunications and Information Administration.

**6.4-**Experimental research and development transmissions by fixed radiolocation systems in this band in the United States within 250 km of the United States-Canada border will be on a non-interference basis and with notification to Canada.

**6.5-**Except for operations on fixed wing aircraft, United States tactical and training radiolocation operations in the 420-430 MHz band will be on a non-interference basis.

**6.6-**Except for the state of Alaska, any future fixed installation radiolocation system proposed for United States operation within 250 km of the United States-Canada border which would normally operate in the 420-430 MHz band will be subject to prior coordination with Canada. The United States will confer with Canada concerning proposed modifications to the characteristics of current radiolocation systems or their replacement, if such modifications or replacements could impose further restrictions on Canadian operations in the Fixed and Mobile Services. In the event that radiolocation operations in the band 420-430 MHz, at Concrete, N.D. or on ships in the Strait of Juan de Fuca are terminated the United States will notify Canada, and the special arrangements herein will cease to apply in the affected Canadian area.

## **ANNEX C**

### **Limits of Effective Radiated Power and Effective Antenna Height for the Band 421-430 MHz**

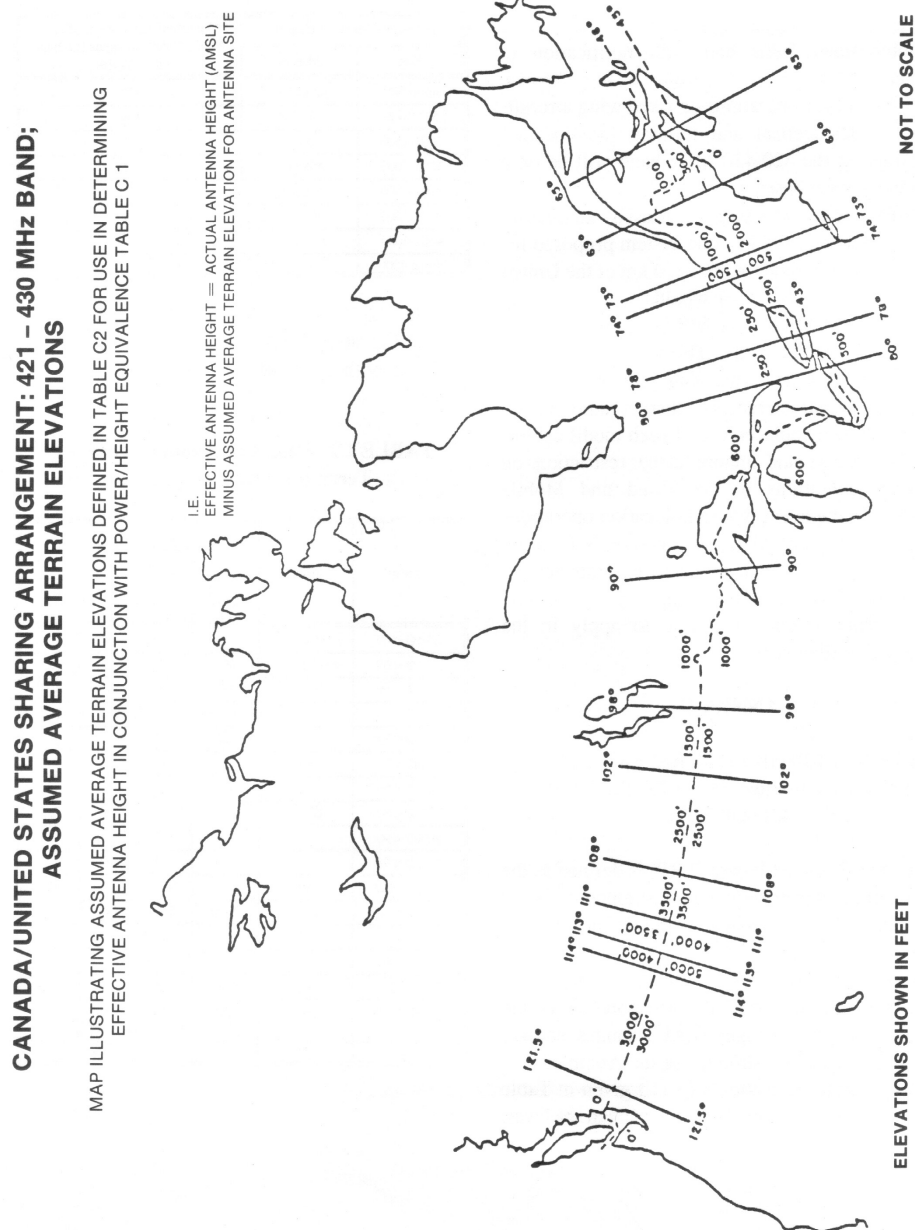
Effective Radiated Power (ERP) is defined as the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

For base stations in the Coordination Zone, Table C1 lists the limits of ERP corresponding to the Effective Antenna Height (EAH) ranges shown. EAH is calculated by subtracting the Assumed Average Terrain Elevation (AATE) given in Table C2 from the antenna elevation above mean sea level.

TABLE C1: Limits of ERP and EAH		
Effective Antenna Height		Maximum Effective Radiated Power (ERP) towards the border, Watts
Feet	Meters	
up to 500	up to 152	250
501-1000	153-305	150
1001-1500	306-457	75
1501-2000	458-609	40
2001-2500	610-762	20
2501-3000	763-914	15
3001-4000	915-1210	10
above 4000	above 1210	5

Table C2 lists the value of Assumed Average Terrain Elevations (AATE) within the Coordination Zone on both sides of the United States-Canada Border.

TABLE C2: Values of Assumed Average Terrain Elevations (AATE)					
Longitude ( $\phi$ )	Latitude $\phi$	Assumed Average Terrain Elevations			
		U.S.		Canada	
		Ft	m	Ft	m
$65 \leq \phi < 69$	$\theta < 45$	0	0	0	0
$65 \leq \phi < 69$	$45 < \theta < 46$	300	91	300	91
$65 \leq \phi < 69$	$\theta \geq 46$	1000	305	1000	305
$69 \leq \phi < 73$	all	2000	609	1000	305
$73 \leq \phi < 74$	all	500	152	500	152
$74 \leq \phi < 78$	all	250	76	250	76
$78 \leq \phi < 80$	$\theta < 43$	500	152	500	152
$78 \leq \phi < 80$	$\theta \geq 43$	250	76	250	76
$80 \leq \phi < 90$	all	600	183	600	183
$90 \leq \phi < 98$	all	1000	305	1000	305
$98 \leq \phi < 102$	all	1500	457	1500	457
$102 \leq \phi < 108$	all	2500	762	2500	762
$108 \leq \phi < 111$	all	3500	1066	3500	1066
$111 \leq \phi < 113$	all	4000	1219	3500	1066
$113 \leq \phi < 114$	all	5000	1524	4000	1219
$114 \leq \phi < 121.5$	all	3000	914	3000	914
$\phi \geq 121.5$	all	0	0	0	0



**Figure 1. Canada/United States Sharing Arrangement 421-430 MHz Band**

## CANADA/UNITED STATES SHARING ARRANGEMENT: 421 – 430 MHz BAND

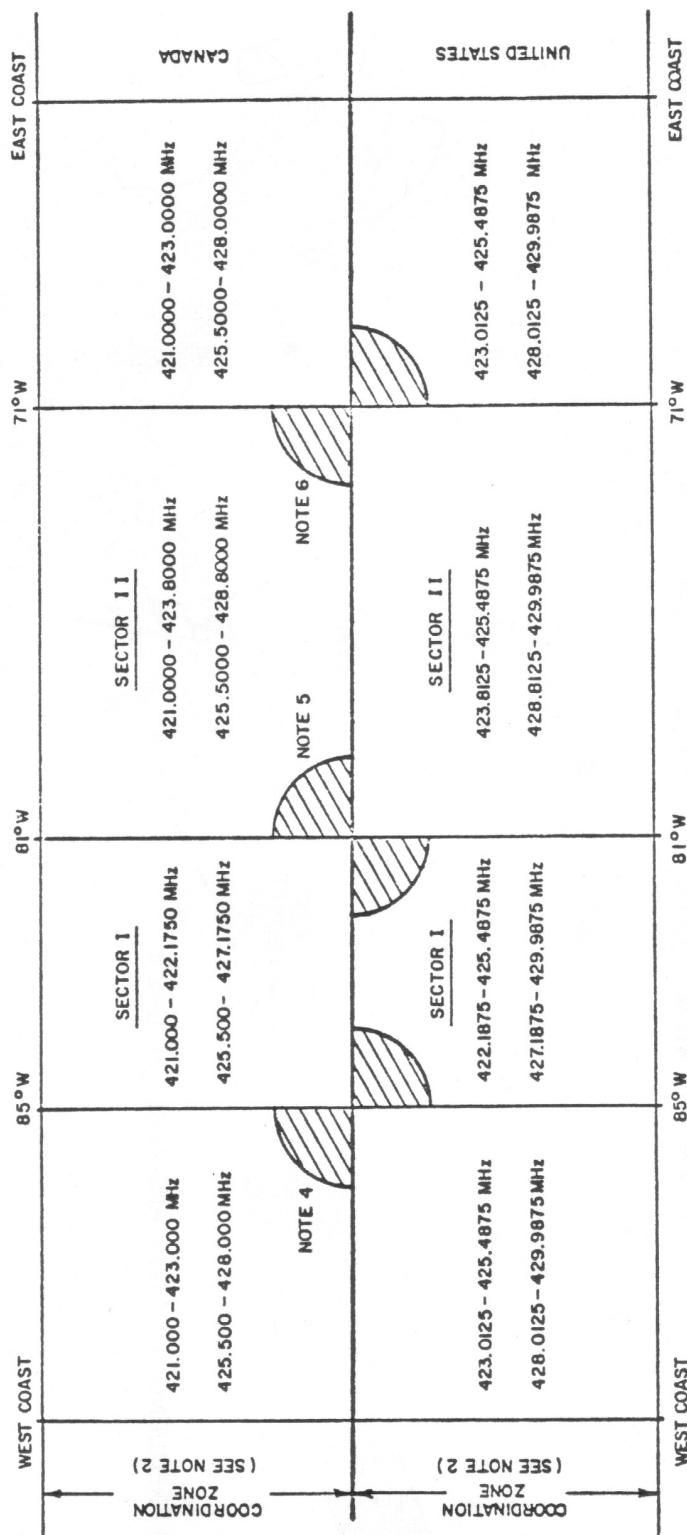


Figure 2. Canada/United States Sharing Arrangement 421-430 MHz Band Coordination Zones

- NOTES:
1. ALL FREQUENCIES IN MEGAHERTZ.
  2. ASSIGNMENTS IN ALASKA/YUKON-BRITISH COLUMBIA COORDINATION ZONE EXCLUDED. SEE SECTION 2.3
  3. ASSIGNMENTS SUBJECT TO ANNEX C REQUIREMENTS.
  4. OVERLAP AREA AT 85°W: FREQUENCY BANDS AFFECTED 422.1875 – 423.0000; 427.1875 – 428.0000 MHz.
  5. OVERLAP AREA AT 81°W: FREQUENCY BANDS AFFECTED 422.1875 – 423.8000; 427.1875 – 428.8000 MHz.
  6. OVERLAP AREA AT 71°W: FREQUENCY BANDS AFFECTED 423.0125 – 423.8000; 428.0125 – 428.8000 MHz.

**CANADA/UNITED STATES SHARING ARRANGEMENT:  
421 – 430 MHz BAND COORDINATION ZONE**

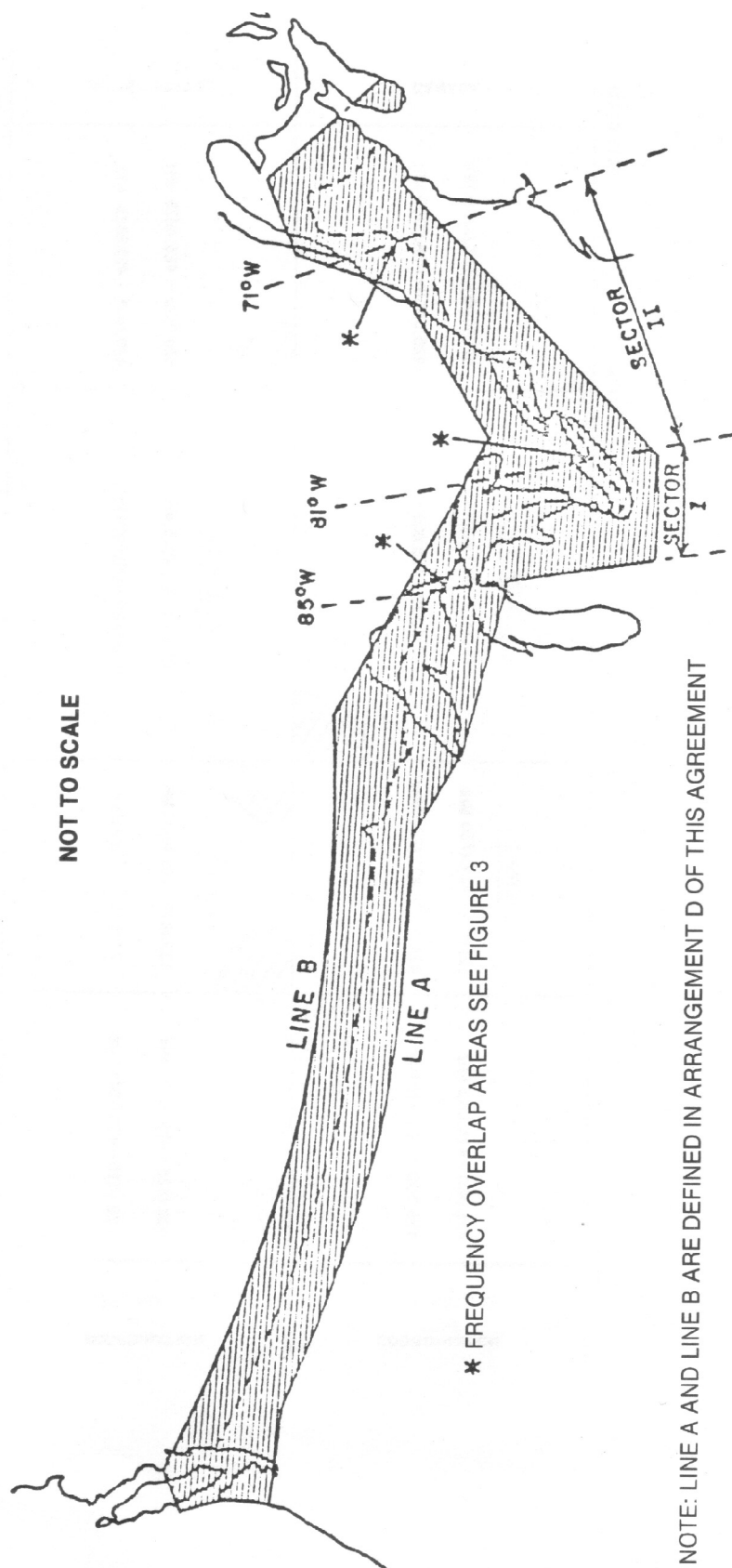
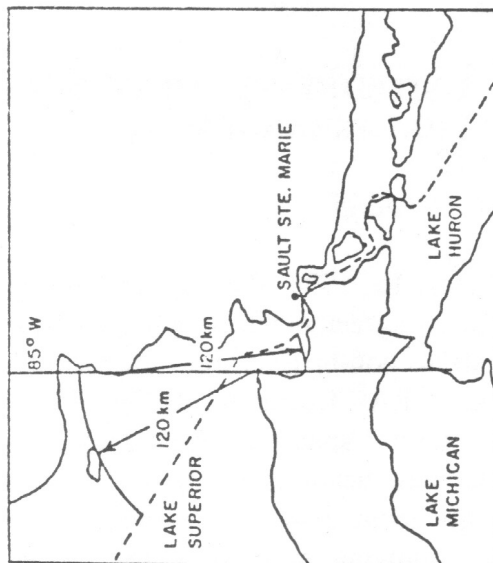
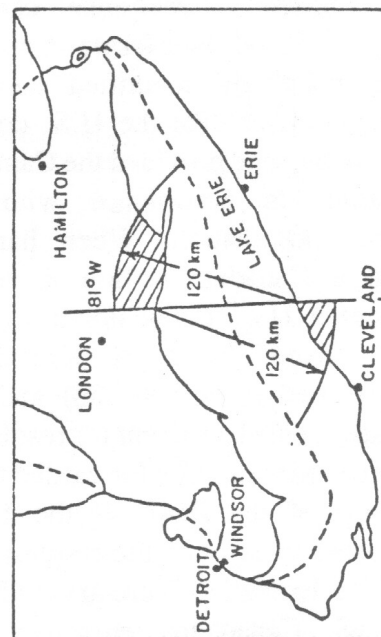


Figure 3. Canada/United States Sharing Arrangement 421-430 MHz Band Overlap Coordination

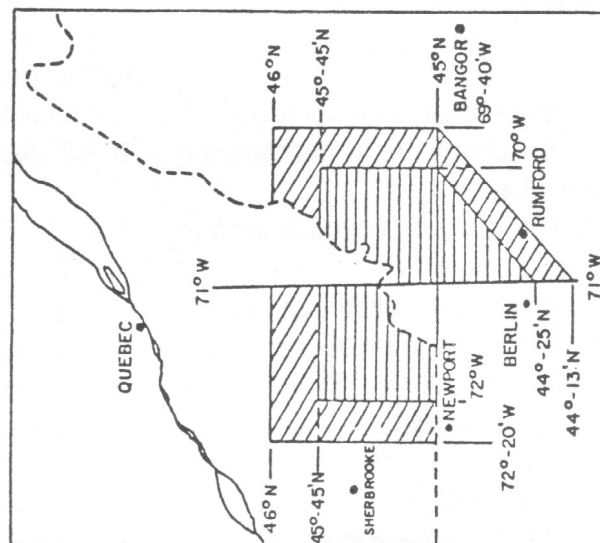
# **CANADA/UNITED STATES SHARING ARRANGEMENT** **421 – 430 MHz BAND:** **BAND OVERLAP COORDINATION**



**PERMITTED CENTRE FREQUENCIES (25 kHz SPACING)**  
 CANADA: 422.2125 – 422.9875 MHz  
 US: 422.200 – 422.975 MHz  
 427.2125 – 427.9875 MHz



**PERMITTED CENTRE FREQUENCIES (25 kHz SPACING)**  
 CANADA: 422.2125 – 423.7875 MHz  
 US: 422.200 – 423.775 MHz  
 427.2125 – 428.7875 MHz



**PERMITTED CENTRE FREQUENCIES (25 kHz SPACING)**  
 CANADA: 423.0375 – 423.7875 MHz  
 US: 423.025 – 423.775 MHz  
 428.0375 – 428.7875 MHz

AREAS IN WHICH COORDINATION IS REQUIRED  
 AREAS IN WHICH COORDINATION IS NOT REQUIRED  
 --- US/CANADA BORDER

**NOT TO SCALE**

## **3.5 FOREIGN REPORTS TO FCC OF INTERFERENCE FROM U.S. GOVERNMENT STATIONS**

The FCC takes the following action upon receipt from another country of a complaint of interference from a U.S. Federal Government station:

- When practicable, the interfering station is positively identified.



b. The complaint is acknowledged and sent by letter of transmittal to the cognizant Federal agency, with copies to the Assistant Secretary of Commerce for Communications and Information and the Department of State.

c. If the cognizant Federal agency responds via FCC channels, the letter or telegram of response is forwarded by the FCC without comment to the government concerned.

### **3.6 PROCEDURE FOR RESOLVING HARMFUL INTERFERENCE FROM CANADIAN STATIONS**

Within the U.S./Canadian coordination border zone, some intermittent interference can be expected; however, if the interfering Canadian station has been positively identified and the coordination date is earlier than the U.S. coordination date, little can be done provided the Canadian station is operating in accordance with the provisions of the coordination. When harmful interference from a Canadian station is severe enough to interrupt a U.S. radiocommunications service and relief from Canada is desired, an interference report (see Section 8.2.30) and any comments which are deemed pertinent for resolution of the harmful interference must be forwarded to the Executive Secretary of the IRAC if the IRAC Secretariat is expected to assist in the resolution of the interference. The Executive Secretary will then take formal action with Canada to attempt to resolve the interference.

### **3.7 APPLICATIONS TO OPERATE WITHIN THE INMARSAT SYSTEM**

The current procedure for processing Federal applications to operate within the International Maritime Satellite (INMARSAT) Organization is contained in Annex E of this manual. Federal Government applicants are to submit their applications through the designated point-of-contact for their agency or department as indicated in the IRAC document referenced above.

### **3.8 INTERNATIONAL AGREEMENTS**

Frequently U.S. Government agencies consummate agreements/understandings with foreign entities (government agencies or international organizations) which include provisions regarding the use of the radio spectrum by U.S. entities. When such agreements/understandings are being developed it is essential that the U.S. agencies involved ensure that the spectrum provisions do not conflict with U.S. policy or spectrum uses, including U.S. overseas operations. The assistance of NTIA and FCC shall be sought if there is any doubt as to conflict with U.S. policy or spectrum use prior to the conclusion of such agreements/understandings.

When such agreements/understandings which have a potential impact on U.S. spectrum use are consummated the responsible agency will promptly provide copies of the spectrum related provisions to NTIA.

### **3.9 UNITED STATES – MEXICO SHARING AND COORDINATION AGREEMENTS, PROTOCOLS AND ARRANGEMENTS**

#### **3.9.1 General**

On June 16, 1994, the United States and Mexico signed an agreement for frequency bands used by terrestrial non-broadcasting radiocommunications services (IRAC Document 28874). Protocols which deal with specific frequency bands and radiocommunications services will be annexed to this agreement as they are signed.

The following table indicates for each of the Protocols the frequency bands and types of assignments involved:

<b>Band</b>	<b>Coordination Remarks</b>	<b>Type of Assignments Involved</b>
190-285 kHz	Protocol 9	Aeronautical
285-435 kHz	Protocol 9	Aeronautical
510-535 kHz	Protocol 9	Aeronautical
74.8-75.2 MHz	Protocol 9	Aeronautical
108-118 MHz	Protocol 9	Aeronautical

118-137 MHz	Protocol 9	Aeronautical
** 138-144 MHz	Administrative Arrangements	Terrestrial Non-Broadcasting
151.190 MHz, 151.280 MHz 151.295 MHz, 151.310 MHz, 159.225 MHz (plus 21 Federal frequencies)	Administrative Arrangements	Emergency/Firefighting Frequencies
162/164/168/172/173 MHz	Administrative Arrangements	International Boundary & Water Commission
162-174 MHz	Administrative Arrangements	Fixed and Mobile
220-222 MHz	Protocol 1	Land Mobile
328.6-335.4 MHz	Protocol 9	Aeronautical
**380-399.9 MHz	Administrative Arrangements	Fixed and Mobile
** 406.1-420 MHz	Administrative Arrangements	Fixed and Mobile
470-512 MHz	Protocol 2	Land Mobile
806-824 MHz	Protocol 3	Land Mobile
824-849 MHz	Protocol 4	Cellular
849-851 MHz	Protocol 5	Public Air-to-Ground
851-869 MHz	Protocol 3	Land Mobile
869-894 MHz	Protocol 4	Cellular
894-896 MHz	Protocol 5	Public Air-to-Ground
896-901 MHz	Protocol 3	Land Mobile
901-902 MHz	Protocol 7	Personal Communications
930-931 MHz	Protocol 7	Personal Communications
932-932.5 MHz	Protocol 6	Fixed
932.5-935 MHz	Protocol 10	Fixed
935-940 MHz	Protocol 3	Land Mobile
940-941 MHz	Protocol 7	Personal Communications
941-941.5 MHz	Protocol 6	Fixed
941.5-944 MHz	Protocol 10	Fixed
960-1215 MHz	Protocol 9	Aeronautical
1215-1400 MHz	Protocol 9	Aeronautical
1850-1990 MHz	Protocol 8	Personal Communications
2700-2900 MHz	Protocol 9	Aeronautical
4200-4400 MHz	Protocol 9	Aeronautical
5000-5250 MHz	Protocol 9	Aeronautical
5350-5470 MHz	Protocol 9	Aeronautical
9000-9200 MHz	Protocol 9	Aeronautical
13.25-13.4 GHz	Protocol 9	Aeronautical
15.4-15.7 GHz	Protocol 9	Aeronautical

Specific protocols and memoranda of understanding involving bands allocated for Federal Government use are given in subsequent sections of this section.

### **3.9.2 Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands by Terrestrial Non-Broadcasting Radiocommunication Services along the Common Border**

(Signed Williamsburg, VA, June 16, 1994)

The Government of the United States of America and the Government of the United Mexican States, the Parties, desiring to continue their mutual understanding and cooperation regarding telecommunications services, recognizing the sovereign right of both countries to manage their telecommunications, taking into account the provisions of Article 24 of the International Telecommunication Convention Nairobi, 1982, and Article 6 of the

Radio Regulations (1982 edition), considered an annex to the Convention, in order to establish the conditions for the use of frequency bands by terrestrial non-broadcasting radiocommunication services along their common border, have agreed as follows:

## **ARTICLE I.**

### **Purposes**

The purposes of this Agreement are:

1. To establish and adopt common plans for the equitable use of frequency bands by terrestrial non-broadcasting radiocommunications services in areas on either side of the common border.
2. To achieve an equitable distribution of the available frequencies.
3. To establish the conditions and technical criteria to regulate the use of the frequencies.

## **ARTICLE II.**

### **Conditions of Use**

The allocation of frequency bands for specific radio services and the conditions for their use shall be as agreed in Protocols which form an integral part of this Agreement and which shall be included in Annex I to this Agreement. A listing of the Protocols shall be maintained in the Index to Annex I.

## **ARTICLE III.**

### **Termination of Previous Agreements**

Upon entry into force, this Agreement supersedes existing agreements between the United States of America and the United Mexican States and memoranda of understanding between the agencies of the governments thereof listed in Annex II of this Agreement and replaces them with the corresponding Protocols included in Annex I of this Agreement.

## **ARTICLE IV.**

### **Implementing Entities**

The entities responsible for implementing this Agreement, herein referred to as the Authorities, shall be, for the United Mexican States, the Secretaría de Comunicaciones y Transportes and, for the United States of America, the Department of State.

The entities responsible for implementing each of the Protocols included in Annex I to this Agreement, herein referred to as the Administrations, shall be as designated by the Authorities in each of the Protocols. In those cases where an Authority designates more than one Administration responsible for implementation of a Protocol, one of the Administrations shall be designated as responsible for coordination with the Administration of the other Party.

## **ARTICLE V.**

### **Amendment of the Agreement and Protocols**

This Agreement may be amended by agreement of the Parties. Said amendments shall enter into force on the date on which both Parties have notified each other by exchange of diplomatic notes that they have complied with the requirements of their respective national legislation.

The annexed Protocols may be amended and additional Protocols concluded by written agreement of the Administrations. Such amendments and additional Protocols shall be included in Annex I of this Agreement by the Parties.

## **ARTICLE VI.**

### **Entry into Force and Duration**

This Agreement shall enter into force on the date on which both Parties have notified each other by exchange of diplomatic notes that they have complied with the requirements of their respective national legislation for entry into force. It shall remain in force until it is replaced by a new agreement or until it is terminated by either Party in accordance with Article VII of this Agreement.

## **ARTICLE VII.**

### **Termination of the Agreement**

This Agreement may be terminated by mutual agreement of the Parties or by either Party by written notice of termination to the other Party through diplomatic channels. Such notice of termination shall enter into effect one year after receipt of the notice.

Any of the Protocols annexed to this Agreement may be terminated by agreement of the Administrations or by either Administration by written notice of termination to the other Administration(s). Such notice of termination shall enter into effect one year after receipt of the notice. Upon termination, Annex I of this Agreement shall be appropriately modified by the Parties.

## **ANNEX I**

### **Index of Protocols Annexed to the Agreement**

#### **Protocol 1**

Protocol Concerning the Allocation and Use of the Channels in the 220-222 MHz Band For Land Mobile Services Along the Common Border

#### **Protocol 2**

Protocol Concerning Use of the 470-512 MHz Band For Land Mobile Services Along the Common Border

#### **Protocol 3**

Protocol Concerning the Use of the 806-824/851-869 and 896-901/935-940 MHz Bands for Land Mobile Services Along the Common Border

#### **Protocol 4**

Protocol Concerning Conditions of Use of the 824-849 and 869-894 MHz Bands for Public Radiocommunications Services Using Cellular Systems Along the Common Border

#### **Protocol 5**

Protocol Concerning the Use of the 849-851 and 894-896 MHz Bands For Public Air-to-Ground Services

#### **Protocol 6**

Protocol Concerning the Allotment and Use of Channels in the 932-932.5 and 941-941.5 MHz Bands for Fixed Point-to-Multipoint Services Along the Common Border

#### **Protocol 7**

Protocol Concerning the Allocation and Use of the Bands 901-902 MHz, 930-931 MHz, and 940-941 MHz

**Protocol 8**

Protocol Concerning the Use of the Band 1850-1990 MHz for Personal Communications Services Along the Common Border

**Protocol 9**

Protocol Concerning the Use of Bands Allocated to the Aeronautical Radionavigation and Aeronautical Communications Services Along the Common Border (in 16 Separate Bands from 190 kHz to 15.7 GHz)

**Protocol 10**

Protocol Concerning the Use of Channels in the 932.5-935 MHz and the 941.5-944 MHz Bands for Fixed Point-to-Point Services Along the Common Border

**Protocol 11**

Protocol Concerning the Use of the 929-930 MHz and 931-932 MHz Bands for Paging Services Along the Common Border

**Protocol 12**

Protocol (on an interim basis) Concerning the Allotment and Use of the 380-399.9 MHz Band for the Fixed and Mobile Terrestrial Non-broadcasting Services Along the Common Border

**Protocol 13**

Protocol Concerning the Allotment and Use of the 406.1-420 MHz Band for Fixed and Mobiles Services Along the Common Border

**Protocol 14**

Protocol (on an interim basis) Concerning the Allotment and Use of the 138-144 MHz Band for Fixed and Mobile Services Along the Common Border

**Protocol 15**

Protocol Concerning the Use of the 698-806 MHz Band for Fixed and Mobile Service Along the Common Border

**Protocol 16**

Protocol (permanent) Concerning the Allotment and Use of the 138-144 MHz band for Fixed and Mobile Services Along the Common Border

**Protocol 17**

Protocol Concerning the Use of the 1710-1755 and the 2110-2155 MHz Bands for Advanced Wireless Services

**Protocol 18**

Protocol (Band not specified for security reasons), Used for Cross Border Public Security Communications

## **Protocol 19**

Protocol (Not yet signed)

## **Protocol 20**

Protocol Concerning the Use of the 4940-4990 MHz Band Used for Fixed and Mobile Services Along the Common Border

## **ANNEX II**

List of Agreements and Memoranda of Understanding Terminated by Article III of this Agreement

Agreement between the United States of America Government and the Government of the United Mexican States Concerning Land Mobile Service in the Bands 470-512 MHz and 806-890 MHz along their Common Border (Signed Mexico City, June 18, 1982.)

Agreement between the Governments of the United States of America and the United Mexican States Regarding Conditions for Utilization of the Bands 825-845 MHz and 870-890 MHz, for Public Radiocommunications Services Using Cellular Systems along the Common U.S.-Mexican Border (Signed Mexico City, September 12, 1988.)

Memorandum of Understanding between the Federal Communications Commission of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States Concerning Conditions of Use of the 824-825, 845-849, and 869-870 MHz Bands for Public Radiocommunications Services Using Cellular Systems along the Common Border (Signed Washington, DC, June 21, 1993.)

Memorandum of Understanding between the Federal Communications Commission of the Government of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States Concerning Conditions of Use of the 890-894 MHz Band for Public Radiocommunications Services Using Cellular Systems along the Common Border (Signed Queretaro, Mexico, August 11, 1992.)

Memorandum of Understanding between the Federal Communications Commission of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States Concerning Private Land Mobile Use of the Bands 821-824 MHz and 866-869 MHz along the Common Border (Signed Chestertown, MD, July 2, 1991.)

Memorandum of Understanding between the Federal Communications Commission of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States Concerning the Use of the 896-901 and 935-940 MHz Bands for the Land Mobile Service along the Common Border (Signed Queretaro, Mexico, August 11, 1992.)

Agreement between the United States of America and the United Mexican States Concerning the Allocation and Use of the Channels in the 220-222 MHz Band along the Common Border (Signed Queretaro, Mexico, August 11, 1992.)

### **3.9.3 Protocol 1 Concerning the Allocation and Use of the Channels in the 220-222 MHz Band for Land Mobile Services along the Common Border**

(Signed Williamsburg, VA, June 16, 1994)

This Protocol is being concluded pursuant to the Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands by Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border signed June 16, 1994, herein referred to as the Agreement.

## **ARTICLE I.**

### **Purposes**

The purposes of this Protocol are:

1. To establish and adopt a common plan for the use of the 220-222 MHz frequency band within a distance of 120 kilometers on each side of the common border (Sharing Zone) and to achieve an equitable distribution of the available channels.

2. To establish technical criteria to regulate the use of the channels.

3. To establish conditions of use so that each Administration may use the channels allotted to the other country, provided this causes no interference.

## **ARTICLE II.**

### **Definitions**

For the purpose of this Protocol and as provided for in Article IV of the Agreement, the term Administration(s) shall refer to the Federal Communications Commission and the National Telecommunications and Information Administration of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States.

## **ARTICLE III.**

### **Conditions of Use**

1. In the agreed Sharing Zone, the Administrations shall use the frequency plan in the Table of Allotment appearing as the Appendix to this Protocol, which shall form an integral part of this Protocol.

2. Within the Sharing Zone, the frequencies in the 220-222 MHz band shall be shared by the Administrations in accordance with the Appendix to this Protocol.

3. The following channels shall be available for the Administrations on an unprotected basis and operated with a maximum effective radiated power (ERP) of 2 watts and a maximum antenna height of 6.1 meters above ground.

Channel	Base	Mobile
195	220.9725 MHz	221.9725 MHz
196	220.9775 MHz	221.9775 MHz
197	220.9825 MHz	221.9825 MHz
198	220.9875 MHz	221.9875 MHz
199	220.9925 MHz	221.9925 MHz
200	220.9975 MHz	221.9975 MHz

4. The assignments which an Administration makes of its own primary use frequencies within the Sharing Zone shall be authorized subject to the effective radiated power (ERP) and antenna height limits specified in the following table:

Antenna Height Above Mean Sea Level Meters	ERP Watts (Maximum)
Up to 150	500
Above 150 to 225	250
Above 225 to 300	125
Above 300 to 450	60
Above 450 to 600	30
Above 600 to 750	20
Above 750 to 900	15
Above 900 to 1,050	10
Above 1,050	5

The maximum effective radiated power allowable for portable/mobile units shall be 50 watts.

5. Each Administration that authorizes the development of major wide area systems in the 220-222 MHz band shall provide the Administration(s) of the other country information about these systems to promote mutual compatibility and benefits.

6. Frequencies allotted for the primary use of one Administration may be assigned by the Administration(s) of the other country within the Sharing Zone in accordance with the following conditions:
- The maximum power flux density (pfd) at any point at or beyond the border shall not exceed -86 dBW/m<sup>2</sup>.
  - Administrations shall take proper measures to eliminate any harmful interference caused by their licensees.
  - Each Administration shall grant protection to stations that have primary use of the authorized frequency.
  - Stations operating under this provision shall be considered as secondary and shall not be granted protection against harmful interference from stations that have primary use of the authorized frequency.

#### ARTICLE IV.

##### Exchange of Data

In May of each year, the Federal Communications Commission of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States shall exchange summary lists of all of their country's assignments in the 220-222 MHz band within Sharing Zone.

#### ARTICLE V.

##### Entry Into Force and Termination

This Protocol shall enter into force on the same date as the Agreement. It shall remain in force until it is replaced by a new Protocol, or until it is terminated in accordance with Article VII of the Agreement.

APPENDIX - TABLE OF ALLOTMENT (220-222 MHz Band)			
Channel	Base Frequency	Mobile Frequency	Country
1	220.0025	221.0025	Mexico
2	220.0075	221.0075	Mexico
3	220.0125	221.0125	Mexico
4	220.0175	221.0175	Mexico
5	220.0225	221.0225	Mexico
6	220.0275	221.0275	Mexico
7	220.0325	221.0325	Mexico
8	220.0375	221.0375	Mexico
9	220.0425	221.0425	Mexico
10	220.0475	221.0475	Mexico
11	220.0525	221.0525	Mexico
12	220.0575	221.0575	Mexico
13	220.0625	221.0625	Mexico
14	220.0675	221.0675	Mexico
15	220.0725	221.0725	Mexico
16	220.0775	221.0775	United States
17	220.0825	221.0825	United States
18	220.0875	221.0875	United States
19	220.0925	221.0925	United States
20	220.0975	221.0975	United States
21	220.1025	221.1025	United States
22	220.1075	221.1075	United States
23	220.1125	221.1125	United States
24	220.1175	221.1175	United States
25	220.1225	221.1225	United States
26	220.1275	221.1275	United States
27	220.1325	221.1325	United States



APPENDIX - TABLE OF ALLOTMENT (220-222 MHz Band)			
Channel	Base Frequency	Mobile Frequency	Country
28	220.1375	221.1375	United States
29	220.1425	221.1425	United States
30	220.1475	221.1475	United States
31	220.1525	221.1525	Mexico
32	220.1575	221.1575	Mexico
33	220.1625	221.1625	Mexico
34	220.1675	221.1675	Mexico
35	220.1725	221.1725	Mexico
36	220.1775	221.1775	Mexico
37	220.1825	221.1825	Mexico
38	220.1875	221.1875	Mexico
39	220.1925	221.1925	Mexico
40	220.1975	221.1975	Mexico
41	220.2025	221.2025	Mexico
42	220.2075	221.2075	Mexico
43	220.2125	221.2125	Mexico
44	220.2175	221.2175	Mexico
45	220.2225	221.2225	Mexico
46	220.2275	221.2275	United States
47	220.2325	221.2325	United States
48	220.2375	221.2375	United States
49	220.2425	221.2425	United States
50	220.2475	221.2475	United States
51	220.2525	221.2525	United States
52	220.2575	221.2575	United States
53	220.2625	221.2625	United States
54	220.2675	221.2675	United States
55	220.2725	221.2725	United States
56	220.2775	221.2775	United States
57	220.2825	221.2825	United States
58	220.2875	221.2875	United States
59	220.2925	221.2925	United States
60	220.2975	221.2975	United States
61	220.3025	221.3025	Mexico
62	220.3075	221.3075	Mexico
63	220.3125	221.3125	Mexico
64	220.3175	221.3175	Mexico
65	220.3225	221.3225	Mexico
66	220.3275	221.3275	Mexico
67	220.3325	221.3325	Mexico
68	220.3375	221.3375	Mexico
69	220.3425	221.3425	Mexico
70	220.3475	221.3475	Mexico
71	220.3525	221.3525	Mexico
72	220.3575	221.3575	Mexico
73	220.3625	221.3625	Mexico
74	220.3675	221.3675	Mexico
75	220.3725	221.3725	Mexico

**APPENDIX - TABLE OF ALLOTMENT (220-222 MHz Band)**

<b>Channel</b>	<b>Base Frequency</b>	<b>Mobile Frequency</b>	<b>Country</b>
76	220.3775	221.3775	United States
77	220.3825	221.3825	United States
78	220.3875	221.3875	United States
79	220.3925	221.3925	United States
80	220.3975	221.3975	United States
81	220.4025	221.4025	United States
82	220.4075	221.4075	United States
83	220.4125	221.4125	United States
84	220.4175	221.4175	United States
85	220.4225	221.4225	United States
86	220.4275	221.4275	United States
87	220.4325	221.4325	United States
88	220.4375	221.4375	United States
89	220.4425	221.4425	United States
90	220.4475	221.4475	United States
91	220.4525	221.4525	Mexico
92	220.4575	221.4575	Mexico
93	220.4625	221.4625	Mexico
94	220.4675	221.4675	Mexico
95	220.4725	221.4725	Mexico
96	220.4775	221.4775	Mexico
97	220.4825	221.4825	Mexico
98	220.4875	221.4875	Mexico
99	220.4925	221.4925	Mexico
100	220.4975	221.4975	Mexico
101	220.5025	221.5025	Mexico
102	220.5075	221.5075	Mexico
103	220.5125	221.5125	Mexico
104	220.5175	221.5175	Mexico
105	220.5225	221.5225	Mexico
106	220.5275	221.5275	United States
107	220.5325	221.5325	United States
108	220.5375	221.5375	United States
109	220.5425	221.5425	United States
110	220.5475	221.5475	United States
111	220.5525	221.5525	United States
112	220.5575	221.5575	United States
113	220.5625	221.5625	United States

114	220.5675	221.5675	United States
115	220.5725	221.5725	United States
116	220.5775	221.5775	United States
117	220.5825	221.5825	United States
118	220.5875	221.5875	United States
119	220.5925	221.5925	United States
120	220.5975	221.5975	United States
121	220.6025	221.6025	Mexico
122	220.6075	221.6075	Mexico
123	220.6125	221.6125	Mexico
124	220.6175	221.6175	Mexico
125	220.6225	221.6225	Mexico
126	220.6275	221.6275	Mexico
127	220.6325	221.6325	Mexico
128	220.6375	221.6375	Mexico
129	220.6425	221.6425	Mexico
130	220.6475	221.6475	Mexico
131	220.6525	221.6525	Mexico
132	220.6575	221.6575	Mexico
133	220.6625	221.6625	Mexico
134	220.6675	221.6675	Mexico
135	220.6725	221.6725	Mexico
136	220.6775	221.6775	United States
137	220.6825	221.6825	United States
138	220.6875	221.6875	United States
139	220.6925	221.6925	United States
140	220.6975	221.6975	United States
141	220.7025	221.7025	United States
142	220.7075	221.7075	United States
143	220.7125	221.7125	United States
144	220.7175	221.7175	United States
145	220.7225	221.7225	United States
146	220.7275	221.7275	Mexico
147	220.7325	221.7325	Mexico
148	220.7375	221.7375	Mexico
149	220.7425	221.7425	Mexico
150	220.7475	221.7475	Mexico
151	220.7525	221.7525	Mexico
152	220.7575	221.7575	Mexico
153	220.7625	221.7625	Mexico
154	220.7675	221.7675	Mexico
155	220.7725	221.7725	Mexico
156	220.7775	221.7775	United States
157	220.7825	221.7825	United States
158	220.7875	221.7875	United States
159	220.7925	221.7925	United States
160	220.7975	221.7975	United States
161	220.8025	221.8025	United States
162	220.8075	221.8075	United States
163	220.8125	221.8125	United States

164	220.8175	221.8175	United States
165	220.8225	221.8225	United States
166	220.8275	221.8275	Mexico
167	220.8325	221.8325	Mexico
168	220.8375	221.8375	Mexico
169	220.8425	221.8425	Mexico
170	220.8475	221.8475	Mexico
171	220.8525	221.8525	Mexico
172	220.8575	221.8575	Mexico
173	220.8625	221.8625	Mexico
174	220.8675	221.8675	Mexico
175	220.8725	221.8725	Mexico
176	220.8775	221.8775	Mexico
177	220.8825	221.8825	Mexico
178	220.8875	221.8875	United States
179	220.8925	221.8925	United States
180	220.8975	221.8975	United States
181	220.9025	221.9025	United States
182	220.9075	221.9075	United States
183	220.9125	221.9125	United States
184	220.9175	221.9175	United States
185	220.9225	221.9225	United States
186	220.9275	221.9275	United States
187	220.9325	221.9325	United States
188	220.9375	221.9375	United States
189	220.9425	221.9425	United States
190	220.9475	221.9475	United States
191	220.9525	221.9525	United States
192	220.9575	221.9575	United States
193	220.9625	221.9625	United States
194	220.9675	221.9675	United States
195	220.9725	221.9725	Both Countries
196	220.9775	221.9775	Both Countries
197	220.9825	221.9825	Both Countries
198	220.9875	221.9875	Both Countries
199	220.9925	221.9925	Both Countries
200	220.9975	221.9975	Both Countries

### **3.9.4 Protocol 6 Concerning the Allotment and Use of Channels in the 932-932.5 and 941-941.5 MHz Bands for Fixed Point-to-Multipoint Services along the Common Border**

(Signed Williamsburg, VA, June 16, 1994)

This Protocol is being concluded pursuant to the Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands by Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border signed June 16, 1994, herein referred to as the Agreement.

#### **ARTICLE I.**

##### **Purposes**

The purposes of this Protocol are:

1. To establish and adopt an allotment plan for the use of channels in the 932-932.5 and 941-941.5 MHz bands within a distance of 113 kilometers on each side of the common border (Sharing Zone) for fixed point-to-multipoint radiocommunication stations and to achieve an equitable distribution of the available channels.
2. To establish technical criteria to regulate point-to-multipoint radiocommunication stations in the 932-932.5 and 941-941.5 MHz bands.
3. To establish conditions of use so that each Administration may use the channels allotted to the other country, if this use causes no interference.

## **ARTICLE II.**

### **Definition**

For the purpose of this Protocol and as provided for in Article IV of the Agreement, the term Administration(s) shall refer to the Federal Communications Commission and the National Telecommunications and Information Administration of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States.

## **ARTICLE III.**

### **Conditions of Use**

1. In the agreed Sharing Zone, Administrations shall use the frequency plan in the Table of Allotment appearing as the Appendix to this Protocol, which shall form an integral part of this Protocol.
2. Within the Sharing Zone, the frequencies in the 932-932.5 and 941-941.5 MHz bands shall be shared by the Administrations in accordance with the Appendix to this Protocol.
3. The assignments which a country makes of its own primary use frequencies within the Sharing Zone shall be authorize subject to the effective isotropic radiated power (EIRP) and antenna height limits specified in the following table:
  - a. Station use of the 941-941.5 MHz band:

Antenna Height/Above Mean Sea Level (Meters)	Maximum Effective Radiated Power (Watts)	Isotropic (EIRP) (dBW)
Up to 152	1000	30
Above 152 to 182	630	28
Above 182 to 213	500	27
Above 213 to 243	400	26
Above 243 to 274	315	25
Above 274 to 305	250	24
Above 305	200	23

- b. Stations using the 932-932.5 MHz band shall be limited to the maximum effective isotropic radiated power of 50 watts (17 dBW).
4. Frequencies allotted for the primary use of one country may be assigned by the other country within the Sharing Zone in accordance with the following conditions:
  - a. The maximum power flux density (pfd) at any point at or beyond the border shall not exceed - 100 dBW/m<sup>2</sup>.
  - b. Administrations shall take proper measures to eliminate any harmful interference caused by their licensees.
  - c. Each Administration shall grant protection to stations that have primary use of the authorized frequency.
  - d. Stations operating under this provision shall be considered as secondary and shall not be granted protection against harmful interference from stations that have primary use of the authorized frequency.

## **ARTICLE IV.**

### **Transborder Traffic**

Administrations will make their best efforts to satisfy the needs of transborder traffic.

## ARTICLE V.

### Exchange of Data

In October of each year, the Federal Commission for the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States shall exchange summary lists of all of their country's assignments in the 932-932.5 and 941-941.5 MHz bands within Sharing Zone.

## ARTICLE VI.

### Entry Into Force and Termination

This Protocol shall enter into force on the same date as the Agreement. It shall remain in force until it is replaced by a new Protocol, or until it is terminated in accordance with Article VII of the Agreement.

### APPENDIX - TABLE OF ALLOTMENT 932-932.5 and 941-941.5 MHz Bands

Channel Pairs for Point-to-Multipoint Assignments			
Mexico		United States	
932.00625	941.00625	932.25625	941.25625
932.01875	941.01875	932.26875	941.26875
932.03125	941.03125	932.28125	941.28125
932.04375	941.04375	932.29375	941.29375
932.05625	941.05625	932.30625	941.30625
932.06875	941.06875	932.31875	941.31875
932.08125	941.08125	932.33125	941.33125
932.09375	941.09375	932.34375	941.34375
932.10625	941.10625	932.35625	941.35625
932.11875	941.11875	932.36875	941.36875
932.13125	941.13125	932.38125	941.38125
932.14375	941.14375	932.39375	941.39375
932.15625	941.15625	932.40625	941.40625
932.16875	941.16875	932.41875	941.41875
932.18125	941.18125	932.43125	941.43125
932.19375	941.19375	932.44375	941.44375
932.20625	941.20625	932.45625	941.45625
932.21875	941.21875	932.46875	941.46875
932.23125	941.23125	932.48125	941.48125
932.24375	941.24375	932.49375	941.49375

### 3.9.5 Protocol 9 Concerning the Use of Bands Allocated to the Aeronautical Radionavigation and Aeronautical Communications Services Along the Common Border (in 16 Separate Bands from 190 kHz to 15.7 GHz)

(Signed Morelia, Mexico, April 26, 1996)

This Protocol is being concluded pursuant to the Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands by Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border signed June 16, 1994, herein referred to as the Agreement.

## ARTICLE I.

### Purposes

The purposes of this Protocol are:

1. To establish a procedure for the coordination of frequency assignment information and the exchange of engineering comments on proposed frequency assignments for Aeronautical Radionavigation and Aeronautical Communications Services along the Mexico/United States common border.
2. To establish the frequency bands and technical criteria that is to be provided as part of the coordination of proposed frequency assignments.
3. To establish conditions of use so that each Administration has access to all of the channels in each of the frequency bands, provided that the use does not cause harmful interference to stations in the other country.

## ARTICLE II.

### Definition

For the purpose of this Protocol and as provided for in Article IV of the Agreement, the term Administration(s) shall refer to the Federal Aviation Administration and the Federal Communications Commission of the United States of America and the Secretaría de Comunicaciones y Transportes (SCT/SENEAM) of the United Mexican States.

## ARTICLE III.

### Conditions of Use

1. The frequency bands set forth in the table below shall be used for aeronautical radionavigation, and aeronautical communications and associated uses in accordance with Appendix I:

Item	Frequency Band	Authorized Coordination Agencies	
		U.S.	Mexico
1	190-285 kHz	FAA	SCT/SENEAM
2	285-435 kHz	FAA	SCT/SENEAM
3	510-535 kHz	FAA	SCT/SENEAM
4	74.8-75.2 MHz	FAA	SCT/SENEAM
5	108-118 MHz	FAA/FCC	SCT/SENEAM
6	118-137 MHz	FAA/FCC	SCT/SENEAM
7	328.6-335.4 MHz	FAA	SCT/SENEAM
8	960-1215 MHz	FAA	SCT/SENEAM
9	1215-1400 MHz	FAA	SCT/SENEAM
10	2700-2900 MHz	FAA	SCT/SENEAM
11	4200-4400 MHz	*	*
12	5000-5250 MHz	FAA/FCC	SCT/SENEAM
13	5350-5470 MHz	*	*
14	9000-9200 MHz	FAA/FCC	SCT/SENEAM
15	13.25-13.4 GHz	*	*
16	15.4-15.7 GHz	*	*

\* No coordination required at this time.

2. The above-mentioned frequency bands are available for use by both countries subject to coordination in the zones established in Appendix I.

## ARTICLE IV.

### Coordination Procedures

1. Before an Administration authorizes a new assignment or a modification to an existing assignment in the frequency bands governed by this protocol in the coordination zones established in Appendix I, it shall coordinate the assignment with the other country. A coordination request shall include the information required for that communication service as listed in Appendix I. The Program Director for Spectrum Policy and Management of the Federal Aviation Administration and the Gerencia de Normas Operacionales de la Secretaría de Comunicaciones y Transportes (SCT/SENEAM) shall conduct the coordination. The medium used for providing the information shall be established by mutual agreement, and the receiving Administration shall acknowledge receipt of the coordination request.

2. The affected Administration shall examine the coordination request and shall reply as soon as practicable advising whether or not a conflict is anticipated. If so, the details of the conflict and the particulars of the station likely to experience interference shall be supplied. A counter proposal or discussions on the initial proposal may be initiated with the objective of resolving any problem.

3. If adverse comment is not received from the affected Administration with 30 days from the date of the receipt of the proposal, the initiating administration may go ahead with the operation after having notified the other Administration.

4. Whenever differences of opinion concerning the probability of harmful interference exist, which cannot be resolved otherwise, or in cases where the information available makes it difficult to determine whether harmful interference would be created by the proposed operation, mutually acceptable arrangements should be made for actual on-the-air tests to be observed by representatives of both the Federal Aviation Administration and Secretaría de Comunicaciones y Transportes/SENEAM. Should harmful interference be caused to the existing station, the administration having jurisdiction over the proposed operation should be notified promptly so that the transmissions of the interfering station may be halted.

5. Neither the Federal Aviation Administration nor Secretaría de Comunicaciones Y Transportes/SENEAM shall be bound to act in accordance with the views of the other. However, to keep such instances to a minimum, each agency should cooperate to the fullest extent practicable with the other by furnishing such additional data as may be required.

## **ARTICLE V.**

### **Master List of Aeronautical Stations**

1. Appendices III and IV\* to this Protocol list the existing stations (and their associated technical parameters) of each Administration that are in the frequency bands covered by this Protocol. These stations comprise the initial Master List and are entitled to the protections accorded stations coordinated pursuant to this Protocol. Any future modifications to these stations shall be coordinated with the other Administration in accordance with Article IV of this Protocol.

2. In June of each year, the Federal Aviation Administration and Secretaría de Comunicaciones y Transportes/SENEAM shall exchange recapitulative lists of all of their country's assignments for Aeronautical Radionavigation and Aeronautical Communications Services within the coordination zones.

\* Appendix III (List of U.S. Assignments) and Appendix IV (List of Mexican Assignments) to be maintained by the FAA.

## **ARTICLE VI.**

### **Entry into Force and Termination**

This Protocol shall enter into force on the date of signing. It shall remain in force until it is replaced by a new Protocol, or until it is terminated in accordance with Article VII of the Agreement.

## **APPENDIX I**

### **AERONAUTICAL RADIONAVIGATION SERVICE**



NDB	190-285, 285-435 and 510-535 kHz
OM/MM	74.8-75.2 MHz
ILS-LOC	108-112 MHz
VOR	108-117.975 MHz
ILS-GS	328.6-335.4 MHz
DME/TACAN	960-1215 MHz
SSR	1030 MHz
Radar	1215-1400 MHz, 2700-2900 MHz, 9000-9200 MHz
MLS	5000-5150 MHz*

\* At the present time, there is no MLS use in the band 5091-5150 MHz.

### Technical Data Required for Coordination

- (a) Frequency (provide pulse repetition frequency for SSR)
- (b) Location Name and Geographical Coordinates (NAD-83)
- (c) Class of Emission and Necessary Bandwidth
- (d) Transmitter Mean Power Output (Peak for DME and SSR)
- (e) Antenna Azimuth and Gain in the Event of a Directional Antenna Array
- (f) Facility Service Volume in Terms of Altitude and Radius Protected. (Not applicable to OM/MM. Radius only for NDB's)

### Coordination Zones

NDB 0-25W	135 NM of U.S./Mexican Border
26-400W	250 NM of U.S./Mexican Border
OVER 400W	350 NM of U.S./Mexican Border
OM/MM	10 NM of U.S./Mexican Border
ILS-LOC/GS/DME	120 NM of U.S./Mexican Border
VOR/DME/TACAN up to 18,000 ft	200 NM of U.S./Mexican Border
VOR/DME/TACAN up to 75,000 ft	400 NM of U.S./Mexican Border
SSR	200 NM of U.S./Mexican Border
Radar	150 NM of U.S./Mexican Border
MLS	200 NM of U.S./Mexican Border

Note 1 - The power for NDB's is the transmitter mean power output.

Note 2 - DME Channels 1 through 16 and 60 through 69 are excluded from coordination between FAA/Mexico.

Note 3 - The frequency of 1090 MHz is excluded from coordination.

## AERONAUTICAL MOBILE (R) SERVICE - AIR TRAFFIC CONTROL 117.975-137.000 MHz

### Technical Data Required for Coordination

- (a) Frequency
- (b) Location Name and Geographic Coordinates
- (c) Class of Emission and Necessary Bandwidth
- (d) Transmitter Mean Power Output
- (e) Antenna Gain and Azimuth in the Event of a Directional Antenna Array
- (f) Facility Service Volume and Function, e.g., Typical Function Service Volumes:

Helicopter Control	30 NM up to 5,000 ft
Local Control and VFR Radar Advisory	30 NM up to 20,000 ft
Approach Control Including Radar	60 NM up to 25,000 ft
Departure Control including Radar	60 NM up to 20,000 ft
Basic Altitude En Route	100 NM up to 15,000 ft
Intermediate Altitude En Route	100 NM up to 24,000 ft

## Coordination Zones

### Ground Control Frequencies

121.6-121.9 MHz	25 NM of U.S./Mexican Border
Low Altitude (up to 24,000 ft)	400 NM of U.S./Mexican Border
High Altitude (up to 75,000 ft)	600 NM of U.S./Mexican Border

Note 1: The frequency 121.5 MHz is excluded from coordination.

Note 2: For definitions of abbreviations, see Appendix II, Glossary

## APPENDIX II

### GLOSSARY

1. **DISTANCE MEASURING EQUIPMENT (DME)** - Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.
2. **INSTRUMENT LANDING SYSTEM (ILS)** - A precision instrument approach system, which normally consists of the following electronic components and visual aids:
  - a. **Localizer (LOC)** - Provides course guidance to the runway.
  - b. **Glideslope (GS)** - Provides vertical guidance for aircraft during approach and landing.
  - c. **Outer Marker (OM)** - A 75 MHz beacon at or near the glideslope intercept altitude of an ILS approach. The OM is normally located four to seven miles from the runway threshold on the extended centerline of the runway.
  - d. **Middle Marker (MM)** - A 75 MHz marker beacon that defines a point along the glideslope of an ILS normally located at or near the point of decision height (ILS category I - 200 ft.).
  - e. **Approach Lighting System (ALS)** - An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach for landing.
3. **MICROWAVE LANDING SYSTEM (MLS)** - A precision landing system operating in the 5 GHz band.
4. **NONDIRECTIONAL BEACON (NDB)** - A low/medium frequency (L/MF) or ultra high (UHF) frequency radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and “home” or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System (ILS) marker, it is normally called a Compass Locator.
5. **SECONDARY SURVEILLANCE RADAR (SSR)** - Also known as a Radar Beacon. A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the search transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder.
6. **TACTICAL AIR NAVIGATION (TACAN)** - A UHF electronic rho-theta air navigation aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station.
7. **VHF OMNIDIRECTIONAL RANGE (VOR)** - A ground-based electronic navigation aid transmitting VHF navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Air Space. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature.

### 3.9.6 Protocol 10 Concerning the Use of Channels in the 932.5-935 MHz and the 941.5-944 MHz Bands for Fixed Point-to-Point Services Along the Common Border

(Signed Morelia, Mexico, April 26, 1996)

This Protocol is being concluded pursuant to the Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands

by Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border signed June 16, 1994, herein referred to as the Agreement.

## **ARTICLE I.**

### **Purposes**

The purposes of this Protocol are:

1. To establish and adopt a common plan for the use of the 932.5-935 and 941.5-944 MHz bands within a distance of 60 kilometers on each side of the common border (Sharing Zone) for fixed point-to-point radiocommunication stations.
2. To establish the technical criteria that will permit each Administration to have equitable access to the available channels.
3. To establish conditions of use so that each Administration may use the channels allotted to the other country, provided this causes no interference.

## **ARTICLE II.**

### **Definition**

For the purpose of this Protocol and as provided for in Article IV of the Agreement, the term Administration(s) shall refer to the Federal Communications Commission and the National Telecommunications and Information Administration of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States.

## **ARTICLE III.**

### **Conditions of Use**

1. In the Sharing Zone, the frequencies in the 932.5-935 MHz and 941.5-944 MHz bands shall be shared by the Administrations in accordance with the channeling plan in Appendix I\* to this Protocol, which is an integral part hereof. These frequencies can be used singly but any paired use must be in accordance with the Table.
2. For each of the emission bandwidths provided for in Appendix I, the individual channels are designated as being either for the primary use of Mexico or primary use of the United States of America or reserved for future use.

\* In recognition of the fact that Mexico needs to move its present users of these frequencies in the bands 932.5-935 MHz and 941.5-944 MHz to other frequency bands before it can make use of the new frequency allocation, the parties have agreed to this protocol and channeling plan until action is taken under Articles VII and VIII. It is the objective of the Administrations to replace the channeling plan and promote the most efficient use of the channels and maximize the sharing of the channels by both countries.

## **ARTICLE IV.**

### **Technical Criteria**

1. For fixed point-to-point stations in the Sharing Zone, the maximum equivalent isotropically radiated power shall not exceed 26 dBW (400 watts) within 120 degrees in the direction of the common border.
2. The stations must employ antennas that meet or exceed the performance standards for Category B. Category A antennas may be required where coordination or interference problems can be resolved by their use. (see the Table, below.) If Category A antennas are necessary to allow a proposed assignment to be made, they must be employed, beginning with the Administration proposing the assignment.

<b>TABLE. ANTENNA PERFORMANCE STANDARDS</b>							
Antenna Category	Maximum Beamwidth to 3 dB Points (Included angle in degrees)	Minimum Radiation Suppression to Angle in Degrees from Centerline of Main Beam in Decibels					
		10 to 15	15 to 20	20 to 30	30 to 100	100 to 140	140 to 180
A	14	6	11	14	17	20	24
B	20	--	6	10	13	15	20

## **ARTICLE V.**

### **Transborder Traffic**

Transborder transmissions by means of private point-to-point links are permitted subject to the authorizations by both administrations in accordance with their regulations in force. Requests for coordination for this type of transmission shall include information on the transborder service to be provided. See Appendix II.

## **ARTICLE VI.**

### **Exchange of Information**

In October of each year, the Federal Communications Commission of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States shall exchange recapitulative lists of all the assignments made by their countries in the 932.5-935 MHz and 941.5-944 MHz bands within the Sharing Zone, in accordance with Appendix II.

## **ARTICLE VII.**

### **Negotiation of a New Protocol**

Two years from the date of entry into force of this Protocol, the Administrations shall initiate a review of the use of the bands with the objective of preparing a new Protocol prior to the termination of this Protocol which maximizes the use of the radio electric spectrum, while keeping in mind the existing assignments and the needs of the two countries.

## **ARTICLE VIII.**

### **Entry Into Force and Termination**

This Protocol shall enter into force on the date of signing. It shall remain in force until it is replaced by a new Protocol. If a replacement Protocol is not concluded within three years from the entry into force of this Protocol, it is terminated on that date, unless it is mutually agreed by the Administrations to extend it.

## **APPENDIX I**

<b>TABLE OF CHANNELS - 932.5-935 AND 941.5-945 MHz BANDS PAIRED FREQUENCIES FOR POINT-TO-POINT ASSIGNMENTS 25 kHz BANDWIDTH PAIRS</b>			
MEXICO		UNITED STATES	
MHz		MHz	
932.5125	941.5125	934.8375	943.8375
932.5375	941.5375	934.8625	943.8625
932.5625	941.5625	934.8875	943.8875
932.5875	941.5875	934.9125	943.9125

932.6125	941.6125	934.9375	943.9375
932.6375	941.6375	934.9625	943.9625
932.6625	941.6625	934.9875	943.9875

TABLE OF CHANNELS - 932.5-935 AND 941.5-945 MHz BANDS PAIRED FREQUENCIES FOR POINT-TO-POINT ASSIGNMENTS 50 kHz BANDWIDTH PAIRS			
MEXICO		UNITED STATES	
MHz		MHz	
932.7000	941.7000	934.8000	943.8000
* RESERVED - 932.7500 and 941.7500 MHz			

TABLE OF CHANNELS - 932.5-935 AND 941.5-945 MHz BANDS PAIRED FREQUENCIES FOR POINT-TO-POINT ASSIGNMENTS 100 kHz BANDWIDTH PAIRS			
MEXICO		UNITED STATES	
MHz		MHz	
932.8250	941.8250	934.5250	943.5250
932.9250	941.9250	934.6250	943.6250
933.0250	942.0250	934.7250	943.7250

TABLE OF CHANNELS - 932.5-935 AND 941.5-945 MHz BANDS PAIRED FREQUENCIES FOR POINT-TO-POINT ASSIGNMENTS 200 kHz BANDWIDTH PAIRS			
MEXICO		UNITED STATES	
MHz		MHz	
933.1750	942.1750	933.9750	942.9750
933.3750	942.3750	934.1750	943.1750
933.5750	942.5750	934.3750	943.3750
* RESERVED - 933.7750 and 942.7750 MHz			

\* An assignment on a reserved channel can be made by one country only with the concurrence of the other country. An administration requesting concurrence for such an assignment shall provide full justification for its need including an indication that it is not able to satisfy its requirement on any other frequency in the channel plan. Such assignments will be coordinated on a case-by-case basis.

## APPENDIX II

### DATA ELEMENTS USED FOR THE EXCHANGE OF LISTS OF ASSIGNMENTS\*

- Identify number for the assignment
- Radio frequency in Megahertz
- Locations: city and state of the transmitter and receiver
- Latitude and longitude of the transmitter antenna and receiver antenna (degrees, minutes, seconds)
- Emission designator for each carrier
- Total e.i.r.p. in dBW for each carrier
- Transmitter antenna azimuth
- Transmitter antenna polarization
- Maximum transmitter antenna gain in dBi
- Transmitter antenna site ground elevation in meters above mean sea level
- Transmitter antenna radiation centerline height above ground in meters
- Transmitter antenna manufacturer and model number
- Transmitter antenna performance (Category A, B or Other)
- Any other optional information

\* If an administration submits a request for coordination, such a request should include as a minimum, the data elements listed in this Appendix.

### **3.9.7 Protocol 12 - Protocol Between the Department of State of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States Concerning the Allotment and Use of the 380-399.9 MHz Band for Fixed and Mobile Terrestrial Non-Broadcasting Services Along the Common Border**

This Protocol is being concluded on an interim basis pursuant to the Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands by Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border signed in Williamsburg, Virginia June 16, 1994, (herein referred to as the “Agreement”).

#### **ARTICLE I.**

##### **Purposes**

1. The purposes of this Protocol are:
  - a. To establish and adopt a plan for the equitable allotment on an interim basis of the frequency sub-bands in the 380-399.9 MHz band within the Sharing Zone defined in this Protocol;
  - b. To allow for new assignments in frequency sub-bands allotted as primary for each Administration in the 380-399.9 MHz band within the Sharing Zone defined in this Protocol on an interim basis until a more complete protocol governing both new assignments and existing stations can be negotiated and concluded; and
  - c. To allow for temporary cross-border communications on an interim basis as set forth under Article IV, herein.
2. This Protocol does not apply to existing stations for fixed and mobile services in the 380-399.9 MHz band within the Sharing Zone defined in this Protocol.

#### **ARTICLE II.**

##### **Designation of Administrations and Definitions**

1. For the purpose of this Protocol and as provided for in Article IV of the Agreement, the term Administration or Administrations will refer with equal effect to the National Telecommunications and Information Administration of the Department of Commerce United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States are hereby designated the Administrations responsible for the implementation of this Protocol for the United States (hereinafter United States) and the United Mexican States (hereinafter Mexico), respectively, as provided for in Article IV of the Agreement.
2. The Sharing Zone is defined to include the border areas within the United States and Mexico and their respective territorial waters as set forth in Appendix I.

#### **ARTICLE III.**

##### **Restriction on Use of Mobile Satellite Service**

Neither Administration shall introduce the mobile satellite service into the sub-bands allotted for the primary use of the other Party within the Sharing Zone defined herein.

#### **ARTICLE IV.**

##### **Conditions of Use**

1. Within the Sharing Zone, the radio frequency sub-bands in the 380-399.9 MHz band shall be allotted for the primary use of each Administration in accordance with Appendix II. Each Administration shall ensure that new

assignments made on or after the date that this Protocol enters into force are operated in such a way that the transmission bandwidth shall not exceed the primary frequency allotments in Appendix II.

2. Each Administration shall ensure that fixed and mobile stations assigned to primary frequency allotments within the Sharing Zone shall be operated on an interim basis in accordance with the effective radiated power (ERP) and antenna height limitations specified in the following table (Table I):

<b>Table I</b>		
<b>Average of the Antenna Height Above Average Terrain on Standard Radials in the Direction of the Common Border<sup>3</sup></b>	<b>Maximum ERP in Any Direction Toward the Common Border</b>	
Meters	Watts	dBm
Up to 150	500	+56.98
Above 150 to 225	350	+55.44
Above 225 to 300	250	+53.98
Above 300 to 450	200	+53.01
Above 450 to 600	150	+51.76
Above 600 to 750	100	+50.00
Above 750 to 900	75	+48.75
Above 900 to 1,050	50	+46.98
Above 1,050	30	+44.77

3. Notwithstanding Article IV, paragraph 1 herein, which limits new assignments to primary allotments for each Administration, new assignments on the frequencies and their associated bandwidths shown in Appendix III are allowed on a temporary basis at certain stations in the United States so that those U.S. stations may engage in cross-border communications with counter-part stations in Mexico. Those U.S. stations are located in the State of Arizona in the United States and are identified in Appendix IV of this Protocol. Appendix IV also lists the counter-part stations in Mexico. Such temporary new assignments are not allowed on other U.S. stations in any of the border states of the United States.

a. The U.S. Administration may make new temporary assignments to the U.S. stations listed in Appendix IV under the exception set forth in this paragraph only on the condition that no harmful interference is caused to stations in Mexico. In the case of harmful interference to the U.S. stations listed in Appendix IV from Mexican stations, the U.S. Administration will request cooperation from the Mexican Administration in order to ensure viable direct cross-border communications between the stations in each country.

b. The limited temporary use permitted under the terms set forth in the prior provisions of this paragraph may continue only until the two Administrations either find and agree upon an alternative radio-frequency band for the assigned use or until July 1, 2008, whichever occurs first. If the two Administrations agree upon an alternative radio-frequency band for the assigned use for any U.S. station prior to ~~July 1, 2008~~ January 1, 2015<sup>4</sup>, the limited temporary use of the frequencies by that U.S. station shall end when cross-border operations are deployed and transmissions by that U.S. station begins on the alternative frequency band.

## **ARTICLE V.**

### **Appendices**

Appendices I, II, III, and IV are an integral part of this Protocol.

## **ARTICLE VI.**

### **Entry into Force and Termination**

<sup>3</sup> Standard radials are 000, 045, 090, 135, 180, 225, 270 and 315 relative to True North.

<sup>4</sup> The date of July 1, 2008 for the first cross border exception was established by written agreement of the Administrations (NTIA and the SCT) on July 17, 2006 and further extended by written agreement to January 1, 2015, on March 8, 2011.

This Protocol shall enter into force on the date of signature. It shall remain in force until it is replaced by a Protocol governing both new assignments and existing stations, or until it is terminated in accordance with Article VII of the Agreement.

## APPENDIX I

### Areas Within Which the Frequencies Are to Be Protected

#### U.S.- MEXICO SHARING ZONE

The Sharing Zone is defined on an interim basis as the area covered by a distance of 145 kilometers (90.1 miles) from the U.S.-Mexico common border into the national territory of each country and includes areas of the Pacific Ocean and the Gulf of Mexico.

These areas are enclosed by the boundaries shown on the map below and are further defined in Table II.



Table II

The following geographic coordinates define the U.S. - Mexico Sharing Zone on an interim basis in the national territory of each country. Point 1 is located in the Pacific Ocean due west from the U.S.-Mexico common border and is the starting point in defining the Sharing Zone. The boundary of the Sharing Zone is then defined by plotting each geographic point in advancing numerical order in a clockwise direction. Each distance path between consecutive points is traversed by great circle arc.

No.	Degrees/Minutes/Seconds	Decimal Degrees
1	32 14'16"N 118 37'09"W	32.2378N 118.6192W
2	33 44'18"N 119 58'13"W	33.7384N 119.9704W
3	34 00'16"N 114 28'01"W	34.0044N 114.4670W
4	32 37'24"N 110 51'01"W	32.6234N 110.8505W
5	32 38'60"N 109 18'02"W	32.6500N 109.3006W
6	33 05'47"N 108 15'42"W	33.0965N 108.2617W
7	33 01'27"N 106 06'30"W	33.0242N 106.1083W
8	32 46'33"N 105 30'38"W	32.7757N 105.5105W
9	31 21'30"N 103 55'51"W	31.3584N 103.9309W
10	30 39'31"N 103 34'01"W	30.6587N 103.5670W



11	31 11'40"N 102 26'12"W	31.1945N 102.4368W
12	31 02'47"N 101 04'18"W	31.0465N 101.0717W
13	30 51'19"N 100 36'43"W	30.8553N 100.6120W
14	29 54'03"N 099 28'55"W	29.9007N 099.4820W
15	27 21'20"N 097 48'03"W	27.3556N 097.8009W
16	27 21'05"N 095 42'14"W	27.3516N 095.7038W
17	25 58'50"N 095 42'22"W	25.9805N 095.7061W
18	24 33'14"N 095 42'46"W	24.5539N 095.7128W
19	24 32'41"N 097 48'44"W	24.5448N 097.8122W
20	25 15'14"N 099 40'56"W	25.2539N 099.6823W
21	25 40'42"N 100 10'59"W	25.6782N 100.1833W
22	27 52'01"N 101 35'16"W	27.8669N 101.5877W
23	28 29'18"N 101 57'45"W	28.4884N 101.9625W
24	27 58'15"N 102 11'48"W	27.9709N 102.1967W
25	27 38'22"N 103 16'32"W	27.6394N 103.2755W
26	27 54'33"N 103 59'11"W	27.9093N 103.9863W
27	28 30'31"N 105 15'57"W	28.5085N 105.2659W
28	29 13'30"N 105 45'37"W	29.2249N 105.7604W
29	30 19'17"N 106 57'15"W	30.3215N 106.9544W
30	30 01'37"N 107 56'47"W	30.0271N 107.9464W
31	30 01'18"N 111 15'28"W	30.0216N 111.2579W
32	31 14'10"N 115 05'28"W	31.2361N 115.0911W
33	31 21'26"N 115 20'31"W	31.3572N 115.3419W
34	31 14'34"N 116 21'25"W	31.2427N 116.3570W
35	31 08'09"N 117 53'38"W	31.1359N 117.8939W

## APPENDIX II

### Allotment of Frequency Sub-bands in the 380-399.9 MHz Band

Mexico Primary <sup>5</sup>	U.S. Primary <sup>5</sup>
380.0000 - 384.9500	384.9500 - 389.9500
389.9500 - 394.9500	394.9500 - 399.9000

## APPENDIX III

### Temporary Cross-Border Frequencies <sup>6</sup>

382.3000	392.3000
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Each frequency employs an associated bandwidth of plus and minus 12.5 kHz relative to the center carrier frequency, i.e 382.2875-382.3125 MHz and 392.2875-392.3125 MHz.

## APPENDIX IV

List of Certain U.S. and Associated Mexican Stations. The U.S. Stations May Be Assigned Frequencies Set Forth in Appendix III on a Limited Temporary Basis under Article IV, Paragraph 3.

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<sup>5</sup> All Frequencies in MHz

<sup>6</sup> These two frequencies and their associated bandwidths are designated as primary for new assignments by Mexico and may also be assigned for temporary cross-border use only as set forth in Article IV, paragraph 3, to the U.S. stations listed in Appendix IV of this Protocol.

In the State of Arizona:

- 1) U.S. Customs & Border Protection Station, Nogales
- 2) U.S. Customs & Border Protection Station, Naco
- 3) U.S. Customs & Border Protection Station, Douglas
- 4) U.S. Border Patrol Sector Communications Center, Yuma
- 5) County of Santa Cruz, Office of Emergency Management, Nogales
- 6) Police Department of City of Nogales, Nogales
- 7) Cochise County Sheriffs Department, Bisbee
- 8) Police Department of City of Douglas, Douglas
- 9) Police Department of City of San Luis, San Luis
- 10) Police Department of City of Somerton, Somerton

In the State of Sonora:

- 1) C4 Station, Nogales
- 2) C4 Station, Naco
- 3) C4 Station, Agua Prieta (site at Prima Loma)
- 4) C4 Station, San Luis Rio Colorado
- 5) C4 Station, Nogales
- 6) C4 Station, Nogales
- 7) C4 Station, Agua Prieta (site at Prima Loma)
- 8) C4 Station, Agua Prieta (site at Prima Loma)
- 9) C4 Station, San Luis Rio Colorado
- 10) C4 Station, San Luis Rio Colorado

### **3.9.8 Protocol 13 - Protocol Between the Department of State of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States Concerning the Allotment and Use of the 406.1-420 MHz Band for Fixed and Mobile Services Along the Common Border**

This Protocol is being concluded pursuant to the Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands by Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border signed in Williamsburg, Virginia June 16, 1994, (herein referred to as the "Agreement").

#### **ARTICLE I.**

##### **Purposes**

The purposes of this Protocol are:

1. To establish and adopt a plan for the equitable allotment and use of frequency sub-bands in the 406.1-420 MHz band within the Sharing Zone defined in this Protocol;
2. To establish technical criteria to regulate the use of the frequency sub-bands referred to in paragraph 1 of this Article;
3. To establish conditions of use so that each Administration may use the frequency sub-bands allotted to the other country for fixed and mobile services, provided this causes no harmful interference; and
4. To provide special interference protection for certain critical receiver stations specifically identified in Appendix I.

#### **ARTICLE II.**

##### **Definitions**

1. For the purpose of this Protocol and as provided for in Article IV of the Agreement, the term Administration or Administrations will refer with equal effect to the National Telecommunications and Information Administration of the Department of Commerce of the United States of America (hereinafter United States) and to the Secretaría de Comunicaciones y Transportes of the United Mexican States (hereinafter Mexico).

2. The Sharing Zone is defined to include the border areas within the United States and Mexico and their respective territorial waters as set forth in Appendix II.

3. Special interference protection is defined as that protection from harmful interference afforded only to those critical receiver stations specifically identified in Appendix I.

### ARTICLE III.

#### Conditions of Use

1. In the Sharing Zone, the radio frequency sub-bands in the 406.1-420 MHz band shall be allotted for the primary use of each Administration in accordance with Appendix III. Each Administration shall ensure that all stations subject to its jurisdiction in the 406.1-420 MHz band are operated in such a way that the transmission bandwidth on radio channels shall not exceed the primary frequency allotments in Appendix III.

2. Each Administration shall ensure that fixed and mobile stations assigned to primary frequency allotments within the Sharing Zone shall be operated in accordance with the effective radiated power (ERP) and antenna height limitations specified in the following table (Table I):

<b>Table I</b>		
<b>Average of the Antenna Height Above Average Terrain on Standard Radials in the Direction of the Common Border<sup>7</sup></b>	<b>Maximum ERP in Any Direction Toward the Common Border</b>	
<b>Meters</b>	<b>Watts</b>	<b>dBm</b>
Up to 150	500	+56.98
Above 150 to 225	350	+55.44
Above 225 to 300	250	+53.98
Above 300 to 450	200	+53.01
Above 450 to 600	150	+51.76
Above 600 to 750	100	+50.00
Above 750 to 900	75	+48.75
Above 900 to 1,050	50	+46.98
Above 1,050	30	+44.77

Existing stations in primary frequency allotments shall conform with the above power limitations on or before January 1, 2008.

3. Each Administration shall ensure that the operation of stations on aircraft is limited to portable stations situated inside the aircraft, which have a maximum power of 5.0 watts and which do not employ antennas externally mounted on the aircraft. Such stations may only operate in the primary frequency allotments for their Administrations and at an altitude of up to 20,000 feet (6096 meters) above mean sea level. Each Administration shall take measures to eliminate any harmful interference caused by its portable stations situated inside aircraft.

4. Frequencies in sub-bands that are allotted for the primary use of one Administration may be assigned by the other Administration to stations located within the latter Administration's territorial segment of the Sharing Zone in accordance with the following conditions:

a. The maximum power flux density (PFD) at any point at or beyond the common border shall not exceed -143 dBW/m.

b. Land mobile stations and ship stations shall not be operated within 30 kilometers of the common border, and in addition to this distance separation, the power flux density of transmissions from land mobile stations and

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<sup>7</sup> Standard radials are 000, 045, 090, 135, 180, 225, 270 and 315 relative to True North.

ship stations shall, in no case, exceed -143 dBW/m at any point at or beyond the common border.

c. Land portable stations shall not be operated within 10 kilometers of the common border, and in addition to this distance separation, the power flux density of transmissions from portable stations shall, in no case, exceed -143 dBW/m at any point at or beyond the common border.

d. Each Administration shall take proper measures to eliminate any harmful interference caused by stations operating within its own territory pursuant to this Protocol.

e. Each Administration shall ensure protection to stations assigned to radio frequencies in primary allotments of the other Administration operating in accord with this Protocol.

f. Stations operating in accordance with the conditions set forth in this paragraph 4 shall be considered as secondary and shall not be granted protection against harmful interference from stations whose Administration has primary use of the frequency allotment.

5. Beyond the Sharing Zone, each Administration shall have unrestricted use of the 406.1-420 MHz band.

## **ARTICLE IV.**

### **Transition Arrangement for Existing Stations**

1. Each Administration shall ensure that existing stations within the Sharing Zone that are operating in primary frequency sub-bands allotted to the other Administration shall either cease transmissions or assume secondary status on or before January 1, 2008, in accordance with paragraph 2 or 3 below except for the stations listed in Appendix I which are governed by Article V of this Protocol.

2. Existing stations in the following categories, which are operating in primary frequency allotments of the other Administration, shall cease transmissions on or before January 1, 2008:

a. Stations at fixed locations that do not meet the pfd limitation set forth in subparagraph 4.a of Article III of this Protocol;

b. Land mobile stations, ship stations and land portable stations that are located in the areas set forth in subparagraphs 4.b and 4.c of Article III of this Protocol; and

c. Portable stations operated in aircraft located in the Sharing Zone defined in paragraph 2 of Article II.

3. Existing stations that are able to assume secondary status as provided in paragraph 1 of this Article shall conform to the provisions of subparagraphs 4.d, 4.e and 4.f of Article III of this Protocol.

## **ARTICLE V.**

### **Special Interference Protection for Critical Receiver Stations**

1. The critical receiver stations within the 406.1-420 MHz band specifically identified in Appendix I shall be afforded special interference protection from harmful interference notwithstanding the provisions of Article III and Article IV.

2. Any station within the Sharing Zone that causes harmful interference to a critical receiver station or stations specifically identified in Appendix I shall take all remedial measures necessary to eliminate the harmful interference to the protected station or stations and their referenced parameters.

## **ARTICLE VI.**

### **Relation to Other Agreements**

This Protocol forms an integral part of the Agreement and shall be referred to as the Protocol for the 406.1 - 420 MHz band in the Index of Annex I of the Agreement.

## **ARTICLE VII.**

### **Appendices**

Appendices I, II and III are an integral part of this Protocol.

## ARTICLE VIII.

### Entry into Force and Termination

This Protocol shall enter into force on the date of signature. It shall remain in force until it is replaced by a new Protocol, or until it is terminated in accordance with Article VII of the Agreement.

### APPENDIX I

#### CRITICAL RECEIVER STATIONS IN MEXICO IN THE 406.1-420 MHz BAND THAT WILL BE AFFORDED SPECIAL INTERFERENCE PROTECTION

No.	Receiver Station Name	Receiver Frequency in MHz	Receiver Emission Designator	Receiver Geographic Coordinates (NAD 83)  Latitude (N) Longitude (W)	Receiver Antenna Azimuth Relative to True North  (N. 000 E.) (NAD 83)	Receiver Antenna Type, Beamwidth in Degrees & Polarization  "H" or "V"	Receive Antenna Height Above Ground Level In Meters
1	Rep. Cedros	413.9250	3M75F8EJF	25 32 52 100 58 51	187 42 05	Parabolic 14 V	40
2	S.E. Ramos Arizpe Potencia	410.1750	3M75F8EJF	25 35 46 100 54 45	232 03 54	Parabolic 14 V	45
3	Rio Escondido	413.9250	3M75F8EJF	28 29 30 100 41 08	230 52 48	Yagi 45 H	40.9

No.	Theoretical PFD Level of Desired Signal at Receiver in dBm	Associated Transmitter Station Name	Associated Transmitter Location  Latitude (N) Longitude (W)	Nominal Power  (dBW)	Antenna Gain  (dBd)	Effective Radiated Power  ERP (dBW)	Equivalent Isotropically Radiated Power EIRP (dBW)
1 (Cont'd)	-12.8	S.E. Saltillo	25 24 35 101 00 05	10	23	30 *	32.16 *
2 (Cont'd)	-12.8	Rep. Cedros	25 32 52 100 58 51	10	23	30 *	32.16 *
3 (Cont'd)	-36.3	Nava	28 26 00 100 46 00	10	12	19 *	21.16 *

\* Calculation includes 3 dB loss for transmission line

#### CRITICAL RECEIVER STATIONS IN THE UNITED STATES IN THE 406.1-420 MHz BAND THAT WILL BE AFFORDED SPECIAL INTERFERENCE PROTECTION

No.	Receiver Station Name	Receiver Frequency in MHz	Receiver Emission Designator	Receiver Geographic Coordinates (NAD 27)  Latitude (N) Longitude (W)	Receiver Antenna Azimuth Relative to True North (N.000 E.) (NAD27)	Receiver Antenna Type, Beamwidth in Degrees & Polarization "H" or "V"	Receiver Antenna Height Above Ground Level in Meters
1	Laguna Dredge	406.1875	11K00F2D	32 51 19 114 28 55	58	Yagi 60 V	18

2	Telegraph Pass	406.5000	11K00F3E	32 40 12 114 20 06	228	Yagi 45 H	6
3	Gila Substation	407.7875	11K00F2D	32 41 05 114 28 09	304	Yagi 60 V	24
4	Hidden Shores Substation	415.1875	11K00F2D	32 52 05 114 27 28	238	Yagi 60 V	6
5	San Luis	416.4000	11K00F3E	32 29 42 114 45 57	64	Yagi 45 H	6
6	Siphon Drop	416.7875	11K00F2D	32 46 45 114 38 05	124	Yagi 60 V	8

No.	Theoretical PFD Level of Desired Signal at Receiver in dBm	Associated Transmitter Station Name	Associated Transmitter Location Latitude (N) Longitude (W)	Nominal Power (dBW)	Antenna Gain (dBd)	Effective Radiated Power ERP (dBW)	Equivalent Isotropically Radiated Power EIRP (dBW)
1 (Cont'd)	-44.6	Hidden Shores Substation	32 52 05 114 27 28	7	6	13	15.15
2 (Cont'd)	-57	Sonora Substation	32 28 48 114 35 14	7	10	17	19.15
3 (Cont'd)	-60	Siphon Drop	32 46 45 114 38 05	7	6	13	15.15
4 (Cont'd)	-45	Laguna Dredge	32 51 19 114 28 55	7	6	13	15.15
5 (Cont'd)	-58	Telegraph Pass	32 40 12 114 20 06	7	10	17	19.15
6 (Cont'd)	-61	Gila Substation	32 41 05 114 28 09	7	6	13	15.15

## Appendix II

### Areas Within Which the Frequencies Are to Be Protected

#### U.S. - MEXICO SHARING ZONE

The Sharing Zone is defined as the areas covered by a distance of 145 kilometers (90.1 miles) from the U.S.-Mexico common border into the national territory of each country and includes areas of the Pacific Ocean and the Gulf of Mexico.

These areas are enclosed by the boundaries shown on the map below and are further defined in Table II.



**Table II**

The following geographic coordinates define the U.S. - Mexico Sharing Zone in the national territory of each country. Point 1 is located in the Pacific Ocean due west from the U.S.-Mexico common border and is the starting point in defining the Sharing Zone. The boundary of the Sharing Zone is then defined by plotting each geographic point in advancing numerical order in a clockwise direction. Each distance path between consecutive points is traversed by great circle arc.

No.	Degrees/Minutes/Seconds	Decimal Degrees
1	32 14'16"N 118 37'09"W <sup>8</sup>	32.3772N 118.6192W
2	33 44'18"N 119 58'13"W	33.7384N 119.9704W
3	34 00'16"N 114 28'01"W	34.0044N 114.4670W
4	32 37'24"N 110 51'01"W	32.6234N 110.8505W
5	32 38'60"N 109 18'02"W	32.6500N 109.3006W
6	33 05'47"N 108 15'42"W	33.0965N 108.2617W
7	33 01'27"N 106 06'30"W	33.0242N 106.1083W
8	32 46'33"N 105 30'38"W	32.7757N 105.5105W
9	31 21'30"N 103 55'51"W	31.3584N 103.9309W
10	30 39'31"N 103 34'01"W	30.6587N 103.5670W
11	31 11'40"N 102 26'12"W	31.1945N 102.4368W
12	31 02'47"N 101 04'18"W	31.0465N 101.0717W
13	30 51'19"N 100 36'43"W	30.8553N 100.6120W
14	29 54'03"N 099 28'55"W	29.9007N 099.4820W
15	27 21'20"N 097 48'03"W	27.3556N 097.8009W
16	27 21'05"N 095 42'14"W	27.3516N 095.7038W
17	25 58'50"N 095 42'22"W	25.9805N 095.7061W
18	24 33'14"N 095 42'46"W	24.5539N 095.7128W
19	24 32'41"N 097 48'44"W	24.5448N 097.8122W
20	25 15'14"N 099 40'56"W	25.2539N 099.6823W
21	25 40'42"N 100 10'59"W	25.6782N 100.1833W
22	27 52'01"N 101 35'16"W	27.8669N 101.5877W

<sup>8</sup> The "Table II" of the Appendix for the Sharing Zone, coordinate 1 expressed in Decimal Degrees has an appreciable error. The coordinate expressed in Degrees, Minutes and Seconds (DMS) is correct. The DMS coordinate 32 14 16 is shown as Decimal Degrees 32.3772. The conversion to Decimal Degrees should read 32.2378. The Department of State is taking diplomatic action to correct this error.

23	28 29'18"N 101 57'45"W	28.4884N 101.9625W
24	27 58'15"N 102 11'48"W	27.9709N 102.1967W
25	27 38'22"N 103 16'32"W	27.6394N 103.2755W
26	27 54'33"N 103 59'11"W	27.9093N 103.9863W
27	28 30'31"N 105 15'57"W	28.5085N 105.2659W
28	29 13'30"N 105 45'37"W	29.2249N 105.7604W
29	30 19'17"N 106 57'15"W	30.3215N 106.9544W
30	30 01'37"N 107 56'47"W	30.0271N 107.9464W
31	30 01'18"N 111 15'28"W	30.0216N 111.2579W
32	31 14'10"N 115 05'28"W	31.2361N 115.0911W
33	31 21'26"N 115 20'31"W	31.3572N 115.3419W
34	31 14'34"N 116 21'25"W	31.2427N 116.3570W
35	31 08'09"N 117 53'38"W	31.1359N 117.8939W

### APPENDIX III

#### Allotment of Frequency Sub-bands in the 406.1-420 MHz Band

Mexico Primary <sup>9</sup>	U.S. Primary <sup>9</sup>
406.10000 - 408.51875	408.51875 - 410.93125
410.93125 - 413.05000	413.05000 - 415.16875
415.16875 - 417.58125	417.58125 - 420.00000

#### 3.9.9 Protocol 16 (Permanent) Protocol Between the Department of State of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States Concerning the Allotment And Use of the 138-144 MHz Band For Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border

This Protocol is being concluded pursuant to the Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Allocation and Use of Frequency Bands by Terrestrial Non-Broadcasting Radiocommunication Services Along the Common Border signed at Williamsburg, Virginia June 16, 1994, (herein referred to as the "Agreement").

#### ARTICLE I.

##### Purposes

1. The purposes of this Protocol are:
  - a. To establish and adopt a plan for the equitable allotment and use by the two Administrations of frequency sub-bands in the 138-144 MHz band within the Sharing Zone defined in this Protocol;
  - b. To establish technical criteria to regulate the use of the frequency sub-bands referred to in paragraph 1 of this Article for existing stations as well as for newly assigned stations; and
  - c. To establish conditions of use so that each Administration may use the frequency sub-bands allotted for primary use of the other country for fixed and mobile services, provided this causes no harmful interference.

#### ARTICLE II.

##### Designation of Administrations and Definitions

1. The National Telecommunications and Information Administration of the Department of Commerce of the

<sup>9</sup> All Frequencies are in MHz.



United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States are hereby designated the Administrations responsible for the implementation of this Protocol for the United States of America (hereinafter “United States”) and the United Mexican States (hereinafter “Mexico”), respectively, as provided for in Article IV of the Agreement.

2. The Sharing Zone is defined to include the border area within the United States and Mexico and their respective territorial waters as set forth in Appendix I.

### ARTICLE III.

#### Supersession

1. Upon entry into force, this Protocol supersedes the provisions of the Memorandum of Understanding (MOU) Between the Department of Agriculture Forest Service and the Federal Communications Commission of the United States of America and the Secretaría de Comunicaciones y Transportes of the United Mexican States for the Use of Radio-Frequencies, Coordination and Cooperation for Emergency Purposes, signed at Washington and Mexico City December 9, 1998 to the extent that the MOU’s provisions pertain to the two frequencies 139.150 MHz and 142.725 MHz.

2. Upon entry into force, this Protocol also supersedes, in its entirety, the Protocol Between the Department of State of the United States of America and the Secretariat of Communications and Transportation of the United Mexican States Concerning the Allotment and Use of the 138-144 MHz Band for Terrestrial Non-Broadcasting Radiocommunication Services along the Common Border, which Protocol was concluded on an interim basis and was signed at Washington July 17, 2006.

### ARTICLE IV.

#### Conditions of Use

1. Within the Sharing Zone, the frequency sub-bands in the 138-144 MHz band shall be allotted for the primary use of each Administration in accordance with Appendix II. Each Administration shall ensure that stations within its national territory in the 138-144 MHz band are assigned and operated in such a way that the transmissions of those stations shall not exceed the primary frequency allotments in Appendix II.

2. Each Administration shall ensure that fixed and mobile stations assigned to primary frequency allotments within the Sharing Zone shall be operated in accordance with the equivalent isotropically radiated power (EIRP) and antenna height limitations specified in the following table:

<b>Table I</b>		
<b>Average of the Antenna Height Above Average Terrain on Standard Radials in the Direction of the Common Border<sup>10</sup></b>	<b>Maximum EIRP in Any Direction Toward the Common Border</b>	
Meters	Watts	dBm
Up to 150	500	+56.98
Above 150 to 225	350	+55.44
Above 225 to 300	250	+53.98
Above 300 to 450	200	+53.01
Above 450 to 600	150	+51.76
Above 600 to 750	100	+50.00
Above 750 to 900	75	+48.75
Above 900 to 1,050	50	+46.98
Above 1,050	30	+44.77

Existing stations in primary frequency allotments shall conform to the above power limitations on or before

<sup>10</sup> Standard radials are 000°, 045°, 090°, 135°, 180°, 225°, 270° and 315° relative to True North.

January 1, 2011. New assignments shall conform to these limitations beginning on the date of entry into force of this Protocol.

3. Each Administration shall ensure that its stations on aircraft only operate with a maximum EIRP of 10.0 watts, only operate in the primary frequency allotments for that Administration and only operate at an altitude of less than 3,500 feet (1067 meters) above average terrain. Each Administration shall take measures to eliminate any harmful interference caused by its aircraft stations to stations operating on primary allotments or beyond the Sharing Zone in the other country.

4. Frequencies in sub-bands that are allotted for the primary use of one Administration may be assigned by the other Administration to stations located within the latter Administration's territorial segment of the Sharing Zone only in accordance with the following conditions:

a. The maximum power flux density (PFD) at any point at or beyond the common border shall not exceed -143 dBW/m<sup>2</sup>.

b. Land mobile stations and ship stations shall not be operated within 30 kilometers of the common border, and in addition to this distance separation, the PFD of transmissions from land mobile stations and ship stations shall, in no case, exceed -143dBW/m<sup>2</sup> at any point at or beyond the common border.

c. Land portable stations shall not be operated within 10 kilometers of the common border, and in addition to this distance separation, the PFD of transmissions from portable stations shall, in no case, exceed -143 dBW/m<sup>2</sup> at any point at or beyond the common border.

d. New assignments in sub-bands that are allotted for the primary use of one Administration may not be made by the other Administration until January 1, 2011.

e. Each Administration shall take proper measures to eliminate harmful interference in order to ensure protection to stations that are operating on radio frequencies in primary allotments of the other Administration in accord with this Protocol.

f. Stations operating in accordance with the conditions set forth in paragraph 4 of this Article shall be considered as secondary and shall not be granted protection against harmful interference from stations whose Administration has primary use of the frequency allotment.

5. Beyond the Sharing Zone, the Administrations' use of the 138-144 MHz band shall in no way be restricted by this Protocol.

## **ARTICLE V.**

### **Transition Arrangement for Existing Stations**

1. Each Administration shall ensure that existing stations within the Sharing Zone that are operating in primary frequency sub-bands allotted to the other Administration shall either cease transmissions or assume secondary status on or before January 1, 2011, in accordance with either paragraph 2 or 3 below.

2. Existing stations in the following categories, which are operating in primary frequency allotments of the other Administration, shall cease operation on or before January 1, 2011:

a. Stations at fixed locations that do not meet the PFD limitation set forth in subparagraph 4.a of Article IV of this Protocol;

b. Land mobile stations, ship stations and land portable stations that are located in the areas set forth in subparagraphs 4.b and 4.c of Article IV of this Protocol; and

c. Aircraft stations located in the Sharing Zone defined in Appendix I to this Protocol.

3. Existing stations that are able to assume secondary status as provided in paragraph 1 of this Article shall conform to the provisions of subparagraphs 4.e and 4.f of Article IV of this Protocol.

## **ARTICLE VI.**

### **Relation to the Agreement**

This Protocol forms an integral part of the Agreement and shall be referred to as Protocol 16, "Protocol Between the Department of State of the United States of America and the Secretariat of Communications and Transportation of the United Mexican States Concerning the Allotment and Use of the 138-144 MHz Band for Terrestrial Non-

Broadcasting Radiocommunication Services Along the Common Border,” in the Index of Annex I of the Agreement.

## **ARTICLE VII.**

### **Appendices**

Appendices I and II are integral parts of this Protocol.

## **ARTICLE VIII.**

### **Entry into Force and Termination**

This Protocol shall enter into force on the date of signature, and shall remain in force until it is replaced by a new Protocol, or until it is terminated in accordance with Article VII of the Agreement.

IN WITNESS WHEREOF, the respective representatives have signed the present Protocol.

Done at Mexico City this third day of August, 2007, in duplicate, in the English and Spanish languages, both texts being equally authentic.

FOR THE DEPARTMENT OF STATE  
OF THE UNITED STATES OF  
AMERICA

/s/ David A. Gross

\_\_\_\_\_  
Amb. David A. Gross  
U.S. Coordinator for International  
Communications and Information Policy

FOR THE SECRETARIAT OF  
COMMUNICATIONS AND  
TRANSPORTATION OF THE  
UNITED MEXICAN STATES

/s/ Rafael del Villar Alrich

\_\_\_\_\_  
Dr. Rafael del Villar Alrich  
Under Secretary of Communications

/s/ Hector G. Osuna Jaime

\_\_\_\_\_  
Arq. Héctor G. Osuna Jaime  
Chairman, Federal Telecommunications  
Commission

## APPENDIX I

### Areas Within Which the Frequencies Are to Be Protected

#### U.S. - MEXICO SHARING ZONE

The Sharing Zone is defined as the areas covered by a distance of 145 kilometers (90.1 miles) from the U.S.-Mexico common border into the national territory of each country and includes areas of the Pacific Ocean and the Gulf of Mexico.

These areas are enclosed by the boundaries shown on the map below and are further defined in Table II.



Table II

The following geographic coordinates define the U.S.-Mexico Sharing Zone in the national territory of each country. Point 1 is located in the Pacific Ocean due west from the U.S.-Mexico common border and is the starting point in defining the Sharing Zone. The boundary of the Sharing Zone is then defined by plotting each geographic point in advancing numerical order in a clockwise direction. Each distance path between consecutive points is traversed by great circle arc.

No.	Degrees/Minutes/Seconds	Decimal Degrees
1	32 14'16"N 118°37'09"W	32.2378N 118.6192W
2	33 44'18"N 119°58'13"W	33.7384N 119.9704W
3	34 00'16"N 114°28'01"W	34.0044N 114.4670W
4	32 37'24"N 110°51'01"W	32.6234N 110.8505W
5	32 38'60"N 109°18'02"W	32.6500N 109.3006W
6	33 05'47"N 108°15'42"W	33.0965N 108.2617W
7	33 01'27"N 106°06'30"W	33.0242N 106.1083W
8	32 46'33"N 105°30'38"W	32.7757N 105.5105W
9	31 21'30"N 103°55'51"W	31.3584N 103.9309W
10	30 39'31"N 103°34'01"W	30.6587N 103.5670W
11	31 11'40"N 102°26'12"W	31.1945N 102.4368W
12	31 02'47"N 101°04'18"W	31.0465N 101.0717W
13	30 51'19"N 100°36'43"W	30.8553N 100.6120W
14	29 54'03"N 099°28'55"W	29.9007N 099.4820W
15	27 21'20"N 097°48'03"W	27.3556N 097.8009W
16	27 21'05"N 095°42'14"W	27.3516N 095.7038W

17	25 58'50"N 095°42'22"W	25.9805N 095.7061W
18	24 33'14"N 095°42'46"W	24.5539N 095.7128W
19	24 32'41"N 097°48'44"W	24.5448N 097.8122W
20	25 15'14"N 099°40'56"W	25.2539N 099.6823W
21	25 40'42"N 100°10'59"W	25.6782N 100.1833W
22	27 52'01"N 101°35'16"W	27.8669N 101.5877W
23	28 29'18"N 101°57'45"W	28.4884N 101.9625W
24	27 58'15"N 102°11'48"W	27.9709N 102.1967W
25	27 38'22"N 103°16'32"W	27.6394N 103.2755W
26	27 54'33"N 103°59'11"W	27.9093N 103.9863W
27	28 30'31"N 105°15'57"W	28.5085N 105.2659W
28	29 13'30"N 105°45'37"W	29.2249N 105.7604W
29	30 19'17"N 106°57'15"W	30.3215N 106.9544W
30	30 01'37"N 107°56'47"W	30.0271N 107.9464W
31	30 01'18"N 111°15'28"W	30.0216N 111.2579W
32	31 14'10"N 115°05'28"W	31.2361N 115.0911W
33	31 21'26"N 115°20'31"W	31.3572N 115.3419W
34	31 14'34"N 116°21'25"W	31.2427N 116.3570W
35	31 08'09"N 117°53'38"W	31.1359N 117.8939W

## APPENDIX II

### Allotment of Frequency Sub-bands in the 138-144 MHz Band

Mexico Primary *	U.S. Primary *
138.0 - 139.0	139.0 - 140.0
140.0 - 141.0	141.0 - 142.0
142.0 - 143.0	143.0 - 144.0

\* All frequencies in MHz

### 3.9.10 Administrative Arrangement Between the United States of America and the United Mexican States Concerning Frequencies Used by the International Boundary and Water Commission

(Signed Queretaro, Mexico, August 11, 1992)

In accordance with the provisions of Article 7 of the Radio Regulations, considered annexed to the International Telecommunications Convention, Nairobi, 1982, the United States of America and the United Mexican States, the Parties, in recognition of the need to protect from harmful interference certain radio frequencies that are used by the United States and Mexican Sections of the International Boundary and Water Commission, have reached an understanding as set forth in the following:

#### ARTICLE I.

##### Purposes

The purposes of this Administrative Arrangement are:

1. To establish and to protect from harmful interference the radio frequencies used by the United States and Mexican Sections of the International Boundary and Water Commission in administering existing treaties on the subject.
2. To establish that the United States and Mexican Sections of the International Boundary and Water Commission can communicate with each other on their own or each other's radio frequencies set forth in this arrangement.

#### ARTICLE II.

## Frequencies to be Protected

The frequencies used along the United States/Mexico Border by the United States and Mexican Sections of the International Boundary and Water Commission vary from location to location along the border. The frequencies to be used on a shared basis by both Sections of the Commission for land mobile systems are as follows:

In the Border Area East of 101 West

162.025/162.175 MHz -- Repeater transmit, base station/mobile receive only.  
164.175 MHz -- Repeater receive, base station/mobile transmit only.

In the Border Area Between 101 and 103 West

162.025 MHz -- Repeater transmit, mobile receive only.  
164.175 MHz -- Repeater receive, mobile transmit only.

In the Border Area Between 104 and 110 West

172.475 MHz -- Repeater receive, base/gage station/mobile transmit only.  
173.175 MHz -- Repeater/base station/mobile transmit, base station/mobile receive, gage station receive only.

In the Border Area Between 113 50' and 115 15' West

164.475 MHz -- Base station/mobile transmit and receive (Simplex channel).  
168.575 MHz -- Repeater receive, base station/mobile transmit only.  
172.775 MHz -- Repeater/base station/mobile transmit, base station/mobile receive.

In the Border Area Within 50 km of 32 33' North and 117 02' West

164.475 MHz -- Base station/mobile transmit and receive (Simplex system).  
172.475 MHz -- Mobile only transmit and receive.

The frequencies for the exclusive use of the United States Section for hydrological systems and for data collection etc., and that must be protected from harmful interference, are as follows:

In the Border Area East of 101 West

172.4/173.9625 MHz -- Backbone control of repeaters.  
169.425 MHz -- Gage stations transmit, repeater/data collection center receive.  
173.175 MHz -- Repeater transmit, gage stations receive.

In the Border Area Between 101 and 103 West

169.525 MHz -- Gage stations/data collection center transmit, repeater receive.  
171.925 MHz -- Repeater transmit, gage stations/data collection center receive.

The frequencies for the exclusive use of the Mexican Section of the Commission that must be protected from harmful interference are as set forth below:

In the Border Area East of 101 West

171.850 MHz -- Systems of voice and data transmission

172.600 MHz -- Systems of voice and data transmission

In the Border Area Between 101 and 103 West

171.825 MHz -- Systems of voice and data transmission

172.625 MHz -- Systems of voice and data transmission

### **ARTICLE III.**

#### **Technical Parameters of Equipment Associated with the Assignments to be Protected**

The technical parameters of the equipment associated with the radio frequency assignments to be protected by this Administrative Arrangement are set forth in Annex I.

### **ARTICLE IV.**

#### **Areas Within which the Frequencies are to be Protected**

The areas within which both Administrations will protect the frequencies lie between the following two lines and the common border between the United States and Mexico:

The United States line begins at Point Estero on the coast of California at 35 30'N, 121 W running by great circle arc to the intersection of 34 N, 114 W, thence by great circle arc to the intersection of 33 N, 112 W, thence along the parallel 33 N to the intersection of 106 W, thence by great circle arc to the intersection of 31 30'N, 104 W, thence by great circle arc to the intersection of 31 N, 100 W, thence by great circle arc to the intersection of 29 N, 99 W, thence by great circle arc to the intersection of 27 10'N and the Padre Island - Gulf of Mexico shore at 97 23'W, at which point it terminates.

The Mexican line begins at the Pacific Ocean of Baja California, thence along parallel 31 20'N to the Gulf of California, thence by great circle arc to the intersection of 30 10'N, 111 W, thence along parallel 30 10'N to the intersection of 107 W, thence by great circle arc to the intersection of 27 30'N, 104 W, thence by great circle arc to the intersection of 28 N, 102 W, thence by great circle arc to the intersection of 24 40'N, 100 W, thence along parallel 24 40'N to the Gulf of Mexico, at which point it terminates.

The above-mentioned areas are those designated in Annex II to this Arrangement.

As stated in Article II above, not all the frequencies to be protected require protection along the entire border, but, rather, within the interference range of the individual stations.

### **ARTICLE V.**

#### **Protection to be provided**

In recognition of the fact that both Parties have already made a considerable number of frequency assignments in the frequency bands that are used by stations of the International Boundary and Water Commission, both Parties will provide one another with an initial listing of all existing assignments on the frequencies to be protected by this Arrangement and, before issuing a frequency authorization for any new or modified frequency assignment on the frequencies used by the other Party, coordinate and request the concurrence of the other Party.

### **ARTICLE VI.**

#### **Period of Effect of the Administrative Arrangement and Amendments**

This Administrative Arrangement shall enter into force on its date of signature and may be amended by mutual consent of the Parties.

## **ARTICLE VII.**

### **Termination of the Administrative Arrangement**

This Administrative Arrangement may be terminated by mutual agreement of the Parties or by either Party upon six month notice in writing by one of the Parties.

## **ANNEX I**

### **Technical Data for International Boundary & Water Commission, United States Section, VHF Radio Equipment**

#### **Transmitter:**

Channel spacing: 25 kHz

Frequency separation between transmitter and receiver (repeater operation):  
0.5 MHz minimum with duplexer

#### **Power output:**

Base and/or repeater stations -- 15 to 100 watts

Mobiles -- 15 to 110 watts

Handie-talkies -- 5 watts

Modulation: 16KF3E +/- 5 kHz for 100% at 1000 Hz

Oscillator frequency stability: 0.0005% from -30C to +60C ambient.

#### **Frequency tolerance:**

Fixed/Mobile -- 5 ppm

Handie-talkie -- 25 ppm

#### **Transmitter sideband noise:**

-90 dB @ +/- 30 kHz

-105 dB @ +/- 1 MHz

Spurious & harmonics: more than 85 dB below carrier

#### **Receiver:**

Oscillator frequency stability: 0.0005% from -30C to +60C ambient

#### **Sensitivity:**

20 dB Quieting -- 0.5  $\mu$ V

EIA Sinad -- 0.35  $\mu$ V

Selectivity (EIA Sinad): -90 dB

Intermediation (EIA Sinad): -80 dB

Spurious & image rejection: 100 dB minimum

Squelch sensitivity: 0.2  $\mu$ V or less

#### **General:**

Type of antenna:

Fixed system --



0 to 6 dB omnidirectional  
8 to 10 dB directional  
Antenna polarization: Vertical  
Hours: 24 hours (continuous)

### **Technical Data for International Boundary & Water Commission, Mexican Section, VHF Radio Equipment**

Channel spacing: 25 kHz  
Transmitter and receiver frequency separation, duplex system: from 600 kHz to 4.5 MHz

Maximum power output:  
Repeater 100 watts  
Base 60 watts  
Mobile 45 watts  
Handie-Talkies 5 watts  
Necessary bandwidth: 16 kHz  
Emission designator: 16KF3E

Maximum deviation for 100% modulation with 1000 Hz +/- 5 kHz  
Type of antenna: directional or omnidirectional  
Polarization: horizontal or vertical  
Hours: 24 hours  
-105 dB, +/- 1 kHz  
Spurious and harmonics: more than 85 dB below carrier

#### **Receiver:**

Oscillator frequency stability: 0.0005% from -30C to +60C  
Sensitivity: 20 dB Quieting: 0.5  $\mu$ V  
EIA Sinad: 0.35  $\mu$ V  
Selectivity (EIA Sinad): -90 dB  
Intermodulation (EIA Sinad): -80 dB

#### **Transmitter:**

Channel spacing: 25 kHz  
Frequency separation between transmitter and receiver (repeater operation):  
0.5 MHz minimum with duplexer

Power output:  
Base and/or repeater stations -- 15 to 110 watts  
Mobiles -- 15 to 110 watts  
Handie-talkies -- 5 watts

Modulation: 16KF3E +/- 5 kHz for 100% at 1000 Hz  
Oscillator frequency stability: 0.0005% from -30C to +60C

Frequency tolerance:  
Fixed/Mobile -- 5 ppm  
Handie-talkie -- 25 ppm

Transmitter sideband noise: -90 dB, +/- 30 kHz  
Spurious and image rejection: 100 dB minimum  
Squelch sensitivity: 0.2  $\mu$ V or less

#### **General:**

Type of antenna:

Fixed system --

0 to 6 dB omnidirectional

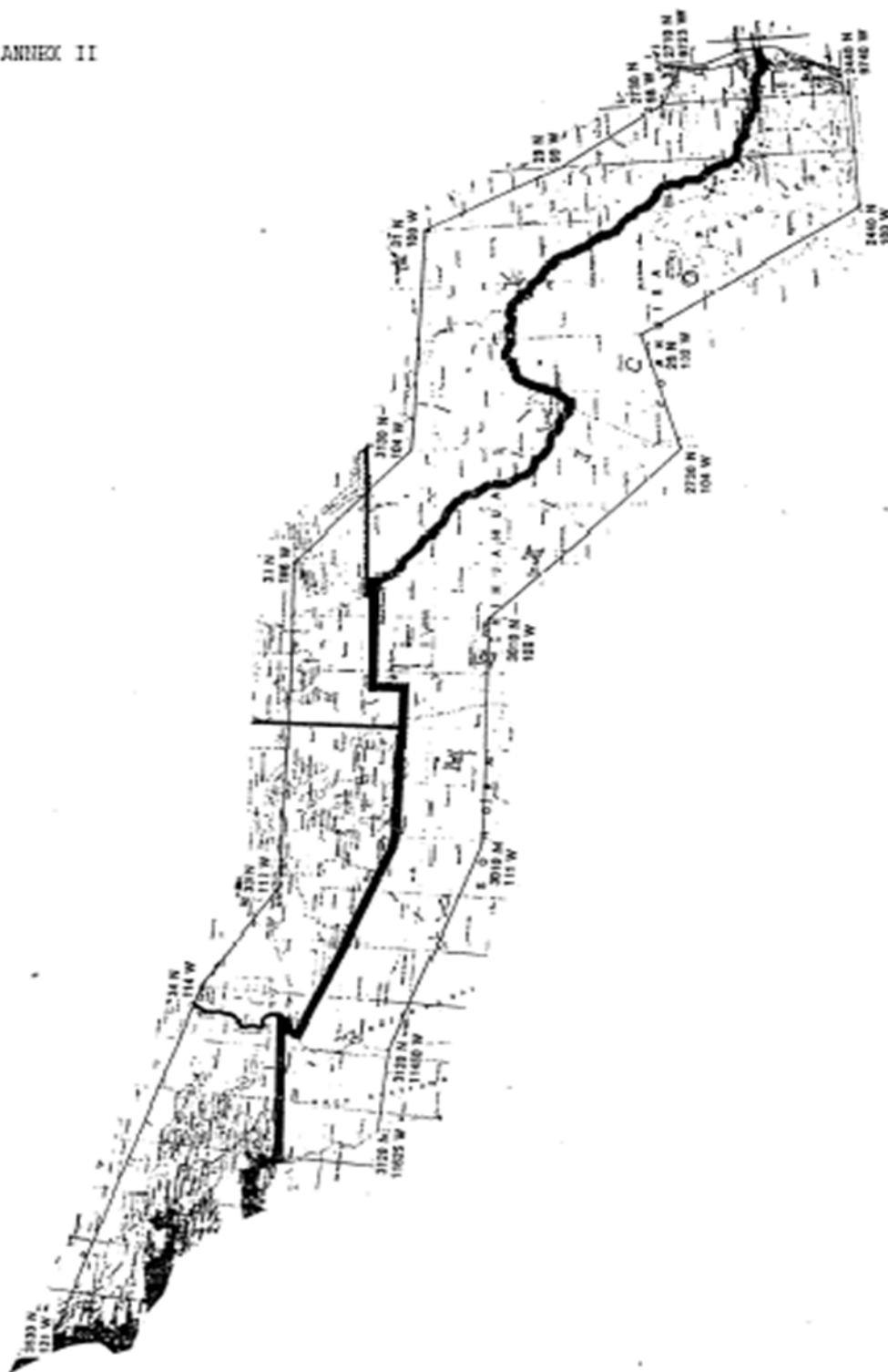
8 to 10 dB directional

Antenna polarization: vertical

Hours of operation: 24 hours a day

## MAP ANNEX II

ANNEX II



### 3.9.11 U.S. and Mexican Special Purpose Operations

The United States and Mexico signed an administrative arrangement on July 2, 1991, concerning radio frequencies used for special purposes (IRAC Doc. 28470). In accordance with this agreement, the Department of the Homeland Security FAS Representative will notify to the Government Master File (GMF) the Mexican frequency uses.

### 3.9.12 Interference Resolution

1. Mexico and the United States have established a commission to effect informal coordination and interference resolution known as the U.S. – Mexico Joint Commission on Resolution of Radio Interference. This commission is also referred to as the “Joint Commission” or “CMERAR” based on its Spanish acronym. The primary purpose of the “Joint Commission” is to resolve interference between U.S. and Mexican users. (Procedures for reporting harmful interference are shown in Section 8.2.30.) The resolution of an interference situation may require either the U.S. user or the Mexican user to change frequency. In order to avoid interference to the same operations in the future, protection shall be afforded both operations.

2. In the United States, the affected U.S. Federal agency FAS Representative shall prepare and submit to the FAS<sup>11</sup> for review and approval the Mexican use if both Administrations agree that Mexico is to remain on the frequency. If the Mexican user is to change frequency, the U.S. Federal agency FAS Representative shall prepare and submit to the FAS for review and approval the proposed Mexican frequency. Until the proposed frequency is approved by the FAS it shall not be proposed to the Mexican user, or agreed to between any U.S. agency and Mexican authorities. In the case where the U.S. agency is proposing a replacement frequency, this is to be done prior to proposing the frequency to Mexico. In the case where the Mexicans are proposing the frequency, this is to be done **prior** to agreeing to their proposal.

3. The Mexican applications will appear on the daily FAS agendas for review. The Mexican application shall bear a “Mexican” serial number. “Mexican” serial numbers are obtained from the FAS.

### 3.9.13 U.S. and Mexico Shared Radio Frequencies and Equipment for Firefighting, Certain Other Emergency, and Disaster Relief Operations

MEMORANDUM OF UNDERSTANDING BETWEEN  
THE DEPARTMENT OF AGRICULTURE FOREST SERVICE AND THE FEDERAL  
COMMUNICATIONS COMMISSION OF THE UNITED STATES OF AMERICA AND  
THE SECRETARÍA DE COMUNICACIONES Y TRANSPORTES OF THE  
UNITED MEXICAN STATES FOR THE USE OF RADIO-FREQUENCIES, COORDINATION AND  
COOPERATION FOR EMERGENCY PURPOSES

The Department of Agriculture (USDA) Forest Service and the Federal Communications Commission (FCC) of the United States of America and the Secretaría de Comunicaciones y Transportes (SCT) of the United Mexican States, hereinafter referred to as the Parties;

**CONSIDERING** the provisions of Article 7 of the Radio Regulations considered annexed to the International Telecommunications Constitution (Geneva, 1992);

**RECOGNIZING** the need to establish shared radio frequencies and radio equipment for firefighting, and certain other emergency, and disaster relief operations,

Have agreed as follows:

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<sup>11</sup> The FAS was delegated authority to address the issues in Section 3.9.12 by the IRAC.

## **ARTICLE I**

### **Purposes**

The purposes of this Memorandum of Understanding (hereinafter MOU) are:

1. To establish procedures for coordinating and cooperating on firefighting, and certain other emergency and disaster relief operations.
2. To identify the Departments and/or agencies that shall cooperate in the sharing of radio equipment to support firefighting, and certain other emergency and disaster relief operations.
3. To establish, and to protect from harmful interference, the radio frequencies to be used by the Parties on a shared basis (hereinafter, emergency frequencies) to support firefighting, and certain other emergency and disaster relief operations.
4. To establish that each Party may use the emergency frequencies in the areas of the common border for the purposes established in this MOU. Within the United States, in the area defined in Annex I, Section II, paragraph 1, the emergency frequencies will be used to support firefighting, and certain other emergency and disaster relief operations that require radio equipment from the National Interagency Fire Center (NIFC). Within Mexico, in the area defined in Annex I, Section II, paragraph 1, the emergency frequencies will be used to support firefighting, and certain other emergency and disaster relief operations.

## **ARTICLE II**

### **Other Participating Departments and/or Agencies**

1. On behalf of the United States, the other participating Department and/or agency in this MOU is the Department of the Interior, acting through the Bureau of Land Management. The National Interagency Fire Center (NIFC), a joint operation of several United States government agencies, including the USDA Forest Service and the Bureau of Land Management, will administer the program of cooperation involving the shared use of radio equipment detailed in Article III of this MOU.
2. On behalf of Mexico, the other participating Departments and/or agencies in this MOU are: the Comisión Federal de Telecomunicaciones (CFT), the Secretaría del Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP), acting through the Dirección General de Forestal, and the Secretaría de Gobernación (SEGOB), acting through the Dirección General de Protección Civil.

## **ARTICLE III**

### **Shared Use of Radio Equipment**

1. The participating Departments and/or agencies in Mexico may request and receive radio equipment provided by NIFC.
2. Requests for radio equipment may be made by written communications or through rapid communication methods between the participating Departments and/or agencies. If the request is not made in writing, it shall be confirmed in writing as soon as possible after the request. Written requests will shall provide an itemization of equipment needed, together with a commitment to make reimbursement in accordance with Annex III of this MOU. Each such request shall be signed by an authorized official as designated in Annex III, Section II.
3. The receiving Departments and/or agencies in Mexico shall reimburse the NIFC in accordance with Annex III, Section II, Letter (D) for any loss, damage, or expense incurred in the operation of the equipment subject to this MOU. Receiving Departments and/or agencies in Mexico shall also reimburse the NIFC for the cost of all expendable materials and transportation. The reimbursement shall be made within one hundred and twenty days after the receipt by the requesting/receiving Department and/or agency of an itemized statement of such costs.
4. Upon signature of this MOU and during the first trimester of each year, the participating Departments and/or agencies shall exchange the names of officials designated to request or provide services under this MOU as part of the establishment of annual operational guidelines (see Annex III for the Operational Guidelines for 1998) for implementation of this MOU. In accordance with the cooperative nature of this MOU, it is permissible and desirable for the participating Departments and/or agencies to exchange recommendations and suggestions designed to render

more effective the operational procedures to be followed in requesting assistance and reimbursing expenses.

5. The technical parameters of the radio equipment available for use pursuant to this MOU are set forth in Annex IV. This Annex may be modified or otherwise updated when the operational guidelines are established each year.

## **ARTICLE IV**

### **Frequency Use and Protection**

In accordance with Annex I, the Parties shall protect from harmful interference the emergency frequencies programmed in the radio equipment used by both Parties on a shared basis to support firefighting, and certain other emergency and disaster relief operations.

## **ARTICLE V**

### **Settlement of Disputes**

1. Nothing in this MOU shall be construed as affecting any existing cooperative arrangements for firefighting or other emergency or disaster relief operations.

2. Any disagreement regarding the application and interpretation of this MOU shall be resolved by agreement between the two parties.

## **Article VI**

### **General Provisions**

1. Nothing in this MOU shall be construed as obligating the Parties to make expenditures or enter into obligations, contractual or otherwise, for the payment of money in excess of appropriations authorized by law and allocated for firefighting or certain other emergency or disaster relief operations.

2. Except for costs set forth in Article III, paragraph 3 of this MOU, neither Party, nor its officials or employees shall be liable on account of any act or omission in consequence of performance of or intended performance of this MOU.

## **ARTICLE VII**

### **Entry Into Force and Amendments**

This MOU shall enter into force upon signature by both Parties and may be amended by mutual agreement of the Parties. Amendments shall enter into force on a date specified by the Parties through an exchange of written modification.

## **ARTICLE VIII**

### **Termination of the Memorandum**

This MOU may be terminated by mutual agreement of the Parties; by its replacement by another bilateral instrument; or by a written notice of termination from either Party. Such notice of termination shall enter into force six months after its is received.

Done in Washington, this ninth day of the month of December of the year nineteen hundred and ninety eight, and in Mexico City, this ninth day of the month of December of the year nineteen hundred and ninety eight, in duplicate, in the English and Spanish languages, both texts being equally authentic.

FOR THE DEPARTMENT OF  
AGRICULTURE FOREST SERVICE  
OF THE UNITED STATES OF  
AMERICA:

Clyde Thompson  
Deputy Chief for Business  
Operations

FOR THE FEDERAL  
COMMUNICATIONS COMMISSION OF  
THE UNITED STATES OF AMERICA:

William E. Kennard  
Chairman

FOR THE SECRETARÍA DE  
COMUNICACIONES Y TRANSPORTES  
OF THE UNITED MEXICAN STATES:

Jorge Nicoln Fischer  
Undersecretary for  
Communications

Javier Lozano Alarcón  
Chairman of the Comisión  
Federal De Telecomunicaciones

## ANNEX I

### FREQUENCY USE AND PROTECTION

This Annex establishes the areas for use and procedures for protection of the emergency frequencies in the radio equipment used by both Parties for firefighting, and certain other emergency and disaster relief operations.

#### I. Frequencies to be Protected

1. The following emergency frequencies (in MHz) shall be protected from harmful interference within the border area, in accordance with Section III of this Annex:

166.6125	166.675	167.100	167.950	142.725 <sup>12</sup>
168.075	168.100	168.400	168.475	
168.550	168.625	168.700	169.150	
169.200	169.750	170.000	170.425	
170.450	170.975	173.8125	139.150 <sup>12</sup>	

2. The following additional emergency frequencies (in MHz) are used for firefighting operations and shall be protected from harmful interference, in accordance with Section III of this Annex, within the border area described in Section II west of 114 degrees West:

151.190	151.280	151.295	151.310
159.225			

#### II. Areas Within Which the Frequencies Are To Be Protected

1. The border areas within which both Parties shall protect the emergency frequencies referred to in Section I lie between the following two lines and the common border between the United States and Mexico:

The United States' line begins at Point Estero on the coast of California at 35 30 N, 121 00 W, running by great circle arc to the intersection of 34 N, 114 W, thence by great circle arc to the intersection of 33 N, 112 W, thence along parallel 33 N to the intersection of 106 W, thence by great circle arc to the intersection of

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<sup>12</sup> Note suppression for this frequency in the Interim Protocol for the 138-144 MHz band.

31 30 N, 104 W, thence by great circle arc to the intersection of 31 N, 100 W, thence by great circle arc to the intersection of 29 N, 99 W, thence by great circle arc to the intersection of 27 30 N, 98 W, and thence by great circle arc to the intersection of 27 10 N, and the Padre Island - Gulf of Mexico shore at 97 23 W, at which point it terminates.

The Mexican line begins at the Pacific Coast of Baja California, running along parallel 31 20 N to the Gulf of California, thence by great circle arc to the intersection of 30 10 N, 111 W, thence along parallel 30 10 N to the intersection of 107 W, thence by great circle arc to the intersection of 27 30 N, 104 W, thence by great circle arc to the intersection of 28 N, 102 W, thence by great circle arc to the intersection of 24 40 N, 100 W, thence along parallel 24 40 N to the Gulf of Mexico, at which point it terminates.

The areas described above are outlined on the attached map, Annex II.

2. Recognizing the fact that radios may be used outside these areas for emergency purposes, both Parties are encouraged to minimize use of the frequencies for other than these purposes.

### III. Protection to be provided

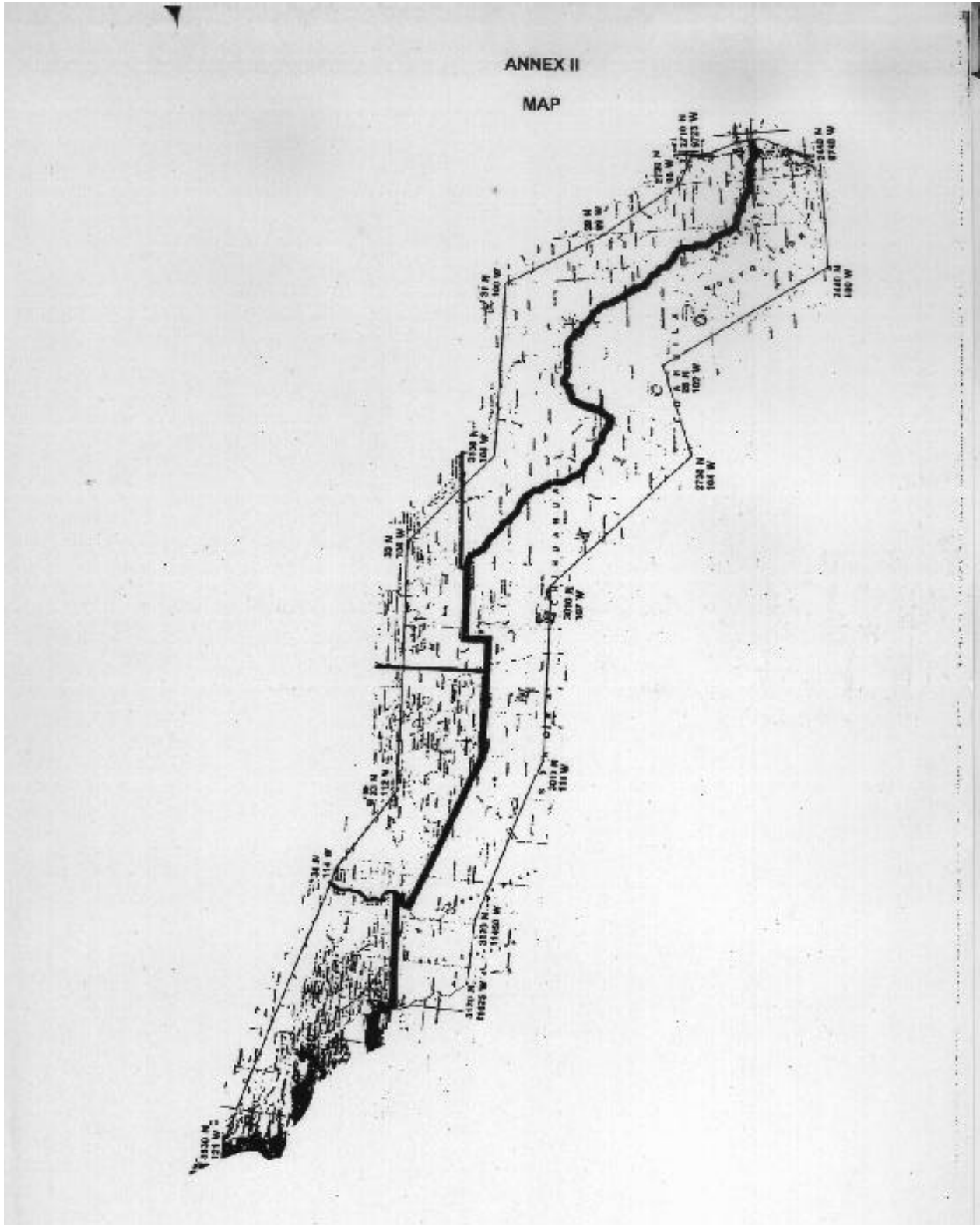
1. The use of emergency frequencies listed in Section I, shall be protected from harmful interference by both Parties as follows:

- 1.1. In recognition of the fact that there are already a considerable number of assignments on the frequencies designated herein as emergency frequencies, each Party shall provide the other with a listing of all existing assignments on the frequencies to be protected by this MOU until they can be moved to other frequencies. Upon entry into force of this MOU, the Parties agree not to authorize use of these frequencies for any purpose inconsistent with this MOU. Furthermore, if, in the course of firefighting or certain other emergency or disaster relief operations, a Party finds that there is harmful interference on an emergency frequency, it may ask the other Party to turn off the transmitter responsible for the interference or modify its operational parameters in order to resolve the interference problem for the duration of the emergency. The Party receiving such a request will comply with it as quickly as possible.
- 1.2. In the United States, within the border area described in Section II, paragraph 1 of this Annex, use of emergency frequencies listed in Section I, paragraph 1 shall be coordinated with the U.S. National Interagency Fire Center prior to each use, and use of emergency frequencies listed in Section I, paragraph 2 shall be coordinated with the FCC, San Diego Office. Use of emergency frequencies in Mexico shall be coordinated with the Secretaría de Comunicaciones y Transportes acting through the Comisión Federal de Telecomunicaciones, prior to each use within the border area described in Section II, paragraph 1 of this Annex.
- 1.3. Each year, during the first trimester, the United States-Mexico Mixed Commission Charged with Resolving Cases of Radio Interference shall undertake monitoring and coordination activities in order to ensure that, in accordance with paragraph 1.1 above, any unauthorized stations using emergency frequencies are closed down before the peak firefighting season begins.



## ANNEX II

### MAP



**ANNEX III**  
**OPERATIONAL GUIDELINES FOR 1998**  
**ANNEX IV**  
**NATIONAL INCIDENT RADIO SUPPORT CACHE**  
**USER'S GUIDE**  
**1998**

**Note:** Annex III does not apply to spectrum management and has not been included in this manual.

Annex IV refers to a User's Guide which is updated annually and is maintained by the U.S. Forest Service, National Interagency Incident Communications Division (NIICD). If you require further information concerning these Annexes contact:

DEPARTMENT OF AGRICULTURE

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**(Last Page in Chapter 3)**

## **Chapter 4**

### **Allocations, Allotments and Plans**

#### **4.1 FREQUENCY ALLOCATIONS**

##### **4.1.1 International Table of Frequency Allocations**

Article 5 of the Radio Regulations of the International Telecommunication Union (Edition of 2020) has been incorporated to the extent practicable in this section on the left side of the Table. The International Table of Frequency Allocations is subdivided into the Region 1 Table, the Region 2 Table, and the Region 3 Table. The International Table is included for informational purposes only.

##### **4.1.2 United States Table of Frequency Allocations**

1. The United States Table of Frequency Allocations is comprised of federal and non-federal Tables of Frequency Allocations. The United States Table indicates the normal national frequency allocation planning and the degree of conformity with the International Table. When required in the national interest and consistent with national rights, as well as obligations undertaken by the United States to other countries that may be affected, additional uses of frequencies in any band may be authorized to meet service needs other than those provided for in the United States Table.

2. Specific exceptions to the United States Table of Frequency Allocations are as follows:

a. A federal frequency assignment may be authorized in a band allocated exclusively for non-federal use, as an exception, provided that a) the assignment is coordinated with the Federal Communications Commission (FCC) and b) no harmful interference will be caused to the service rendered by non-federal stations, present or future.

b. A non-federal frequency assignment may be authorized in a band allocated exclusively for federal use, as an exception, provided that a) the assignment is coordinated with the IRAC and b) no harmful interference will be caused to the service rendered by federal stations, present or future.

3. In the case of bands shared by federal and non-federal services, frequency assignments therein shall be subject to coordination between the NTIA (via IRAC) and the FCC and no priority is recognized unless the terms of such priority are specifically defined in the United States Table of Frequency Allocations or unless they are subject to mutually agreed arrangements in specific cases.

##### **4.1.3 Federal Table of Frequency Allocations**

1. The Federal Table of Frequency Allocations shall be used as a guide in the assignment of radio frequencies to federal radio stations in the United States and Possessions. Exceptions to the Table may be made by the IRAC after careful consideration to avoid harmful interference and to ensure compliance with the ITU Radio Regulations.

2. For the use of frequencies by federal radio stations outside the United States and Possessions, federal agencies shall be guided insofar as practicable by the ITU Table of Frequency Allocations and, where applicable, by the authority of the host government. Maximum practicable effort should be made to avoid the possibility of harmful interference to other authorized U.S. operations. If harmful interference is considered likely, it is incumbent upon the agency conducting the operation to coordinate with other U.S. Flag users, as provided for in Section 8.3.11.

3. Application of the federal table is subject to the recognition that:

a. Below 25000 kHz the table is only applicable in the assignment of frequencies after September 5, 1961; under Article 48 of the International Telecommunication Constitution, administrations “retain their entire freedom with regard to military radio installations of their army, naval and air forces”; and under No. 4.4 of the ITU Radio Regulations, administrations may assign frequencies in derogation of the ITU Table of Frequency Allocations “on the express condition that harmful interference shall not be caused to services carried on by stations operating in accordance with the provisions of the Convention and of these Regulations.”

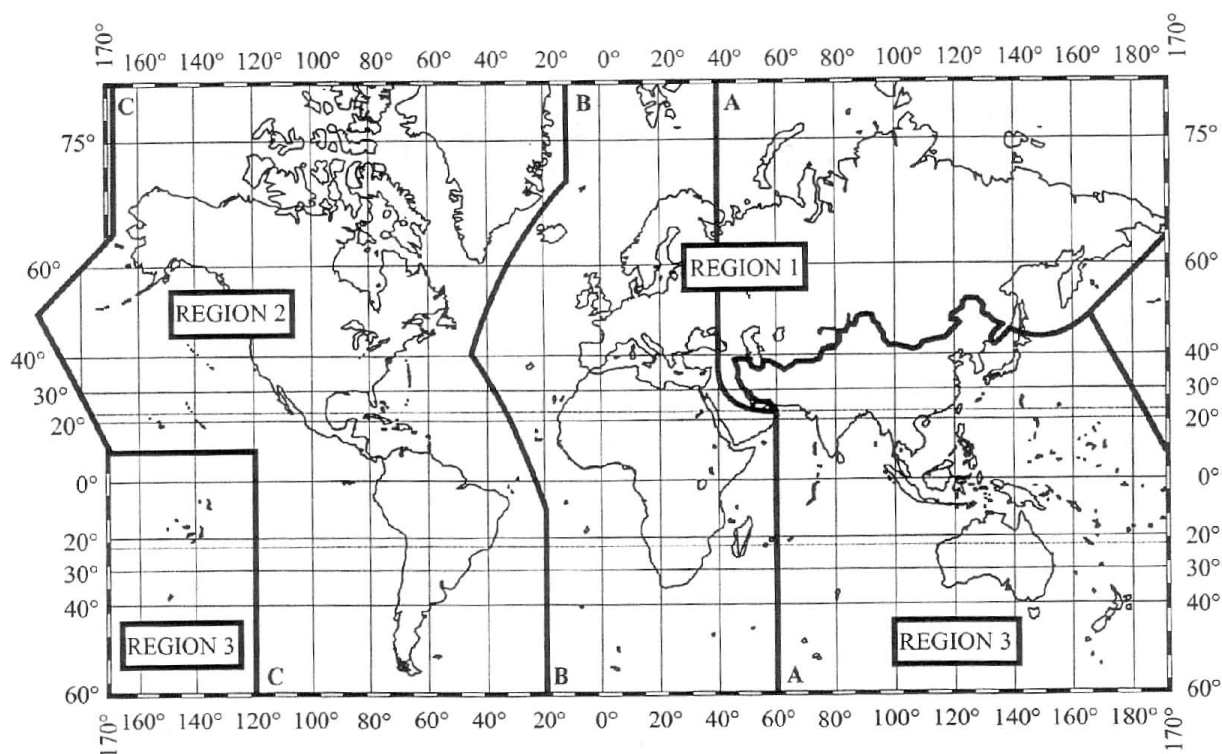
b. Some frequency assignments below 25000 kHz that were made before September 5, 1961, are not in conformity with the Federal Table of Frequency Allocations. Because of the exception mentioned in subparagraph a, the status of these assignments can be determined only on a case-by-case basis. With this exception, the rules pertaining to the relative status between radio services are as follows:

4. Station of a secondary services: are on a non-interference basis to the primary service:

- a. Shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;
  - b. Cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;
  - c. Can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.
5. Additional allocation - where a band is indicated in a footnote of the Table as “also allocated” to a service in an area smaller than a Region, or in a particular country. For example, an allocation which is added in this area or in this country to the service or services which are indicated in the Table.
6. Alternative allocation - where a band is indicated in a footnote of the Table as “allocated” to one or more services in an area smaller than a Region, or in a particular country. For example, an allocation which replaces, in this area or in this country, the allocation indicated in the Table.
7. Different category of service - where the allocation category (primary or secondary) of the service in the Table is changed. For example, the Table reflects the allocation as Fixed, Mobile and RADIOLOCATION, the category of these services are changed by the footnote to FIXED, MOBILE and Radiolocation.
8. An allocation or a footnote to the Federal Table of Frequency Allocations denoting relative status between radio services automatically applies to each assignment in the band to which the footnote or allocation pertains, unless at the time of a particular frequency assignment action a different provision is decided upon for the assignment concerned.
9. A priority note reflecting the same provisions as an allocation or an applicable footnote to the U.S. Federal Table of Frequency Allocations is redundant and shall not be applied to frequency assignments.
10. An assignment that is in conformity with the service allocation (as amplified by pertinent footnotes) for the band in which it is contained takes precedence over assignments therein that are not in conformity unless, at the time of the frequency assignment action, a different provision is decided upon.
11. Where in this Table a band is indicated as allocated to more than one service, such services are listed in the following order:
- a. Services, the names of which are printed in all capital letters (example: FIXED); these services are called “primary” services;
  - b. Services, the names of which are printed in “normal characters” (example: Mobile); these are “secondary” services.
12. The international allocations are contained on the left side of the table, while the U.S. provisions are shown on the right side of the table. Three columns are contained under the U.S. portion of the table. Column 1 contains services allocated for use by federal users. Column 2 provides services allocated for use by non-federal users. Column 3 contains remarks. If all the allocations in Columns 1 and 2 are the same, these columns are shown merged.
- a. Column 1 indicates the band limits for the federal allocations including all “US” and “G” (retained from previously used terminology) footnotes considered to be applicable to the federal users nationally. Where the allocated service is followed by a function in parentheses, e.g., SPACE (space-to-Earth), the allocation is limited to the function shown.
  - b. Column 2 indicates the band limits for the non-federal allocations including all “US” footnotes, and certain “NG” footnotes as contained in Part 2 of the FCC Rules and Regulations. Where the allocated service is followed by a function in parentheses, e.g., SPACE (space-to-Earth), the allocation is limited to the function shown. This non-federal (NG—retained from previously used terminology “Non-Government”.) data has been included in the federal table for information purposes only.
  - c. Column 3 contains such remarks as serve to amplify the federal and non-federal allocation or point out understanding between the FCC and NTIA in respect thereof. The numbers in parenthesis ( ) refer to the FCC Rule Part number. The international footnotes shown in the columns to the left of the double line are applicable only in the relationships between the U.S. and other countries. An international footnote is applicable to the U.S. Table of Allocations if the number also appears in Columns 1 and 2 of the U.S. Table.
13. The international footnote is then applicable to both federal and non-federal use. The text of the footnotes in this Table is listed in numerical order at the end of the table, in sections headed International, United States (US), Non-Federal (NG) and Federal (G) footnotes.

## Chart of Regions as Defined in the Table of Frequency Allocations

For the allocation of frequencies the world has been divided into three Regions as shown in the following map in Nos. 5.3 and 5.9:



The shaded part represents the Tropical Zones as defined in Nos. 5.16 to 5.20 and 5.21.

5-01

# Table of Frequency Allocations

Table of Frequency Allocations			0-137.8 kHz (VLF/LF)		Page 1
International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
Below 8.3 (Not Allocated)			Below 8.3 (Not Allocated)		
5.53 5.54			5.53 5.54		
8.3-9			8.3-9		
METEOROLOGICAL AIDS 5.54A 5.54B 5.54C			METEOROLOGICAL AIDS 5.54A		
9-11.3			9-11.3		
METEOROLOGICAL AIDS 5.54A			METEOROLOGICAL AIDS 5.54A		
RADIONAVIGATION			RADIONAVIGATION US18		
			US2		
11.3-14			11.3-14		
RADIONAVIGATION			RADIONAVIGATION US18		
			US2		
14-19.95			14-19.95	14-19.95	
FIXED			FIXED	Fixed	
MARITIME MOBILE 5.57			MARITIME MOBILE 5.57		
5.55 5.56			US2	US2	
19.95-20.05			19.95-20.05		
STANDARD FREQUENCY AND TIME SIGNAL (20 kHz)			STANDARD FREQUENCY AND TIME SIGNAL (20 kHz)		
			US2		
20.05-70			20.05-59	20.05-59	
FIXED			FIXED	FIXED	
MARITIME MOBILE 5.57			MARITIME MOBILE 5.57		
			US2	US2	
			59-61		
			STANDARD FREQUENCY AND TIME SIGNAL (60 kHz)		
			US2		
			61-70	61-70	
			FIXED	FIXED	
			MARITIME MOBILE 5.57		
			US2	US2	
5.56 5.58					
70-72	70-90	70-72	70-90	70-90	Private Land Mobile (90)
RADIONAVIGATION 5.60	FIXED	RADIONAVIGATION 5.60	FIXED	FIXED	
	MARITIME MOBILE 5.57	Fixed	MARITIME MOBILE 5.57	Radiolocation	
	MARITIME RADIONAVIGATION 5.60	Maritime mobile 5.57	Radiolocation		
	5.59	5.59			
	Radiolocation				
72-84		72-84			
FIXED		FIXED			
MARITIME MOBILE 5.57		MARITIME MOBILE 5.57			
RADIONAVIGATION 5.60		RADIONAVIGATION 5.60			
5.56					
84-86		84-86			
RADIONAVIGATION 5.60		RADIONAVIGATION 5.60			
		Fixed			
		Maritime mobile 5.57			
		5.59			

86-90 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION		86-90 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.60			
5.56	5.61		US2	US2	
90-110 RADIONAVIGATION 5.62 Fixed			90-110 RADIONAVIGATION 5.62 US18		Aviation (87) Private Land Mobile (90)
5.64			US2 US104		
110-112 FIXED MARITIME MOBILE RADIONAVIGATION	110-130 FIXED MARITIME MOBILE MARITIME RADIONAVIGATION 5.60 Radiolocation	110-112 FIXED MARITIME MOBILE RADIONAVIGATION 5.60	110-130 FIXED MARITIME MOBILE Radiolocation		Private Land Mobile (90)
5.64		5.64			
112-115 RADIONAVIGATION 5.60		112-117.6 RADIONAVIGATION 5.60 Fixed Maritime mobile			
115-117.6 RADIONAVIGATION 5.60 Fixed Maritime mobile					
5.64 5.66		5.64 5.65			
117.6-126 FIXED MARITIME MOBILE RADIONAVIGATION 5.60		117.6-126 FIXED MARITIME MOBILE RADIONAVIGATION 5.60			
5.64		5.64			
126-129 RADIONAVIGATION 5.60		126-129 RADIONAVIGATION 5.60 Fixed Maritime mobile			
		5.64 5.65			
129-130 FIXED MARITIME MOBILE RADIONAVIGATION 5.60		129-130 FIXED MARITIME MOBILE RADIONAVIGATION 5.60			
5.64	5.61 5.64	5.64	5.64 US2		
130-135.7 FIXED MARITIME MOBILE	130-135.7 FIXED MARITIME MOBILE	130-135.7 FIXED MARITIME MOBILE RADIONAVIGATION	130-135.7 FIXED MARITIME MOBILE		Maritime (80)
5.64 5.67	5.64	5.64	5.64 US2		
135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A	135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A	135.7-137.8 FIXED MARITIME MOBILE RADIONAVIGATION Amateur 5.67A	135.7-137.8 FIXED MARITIME MOBILE	135.7-137.8 Amateur 5.67A	Amateur Radio (97)
5.64 5.67 5.67B	5.64	5.64 5.67B	5.64 US2	US2	Page 2

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
137.8-148.5 FIXED MARITIME MOBILE 5.64 5.67	137.8-160 FIXED MARITIME MOBILE	137.8-160 FIXED MARITIME MOBILE RADIONAVIGATION	137.8-160 FIXED MARITIME MOBILE		Maritime (80)
148.5-255 BROADCASTING	5.64	5.64	5.64 US2		
	160-190 FIXED	160-190 FIXED Aeronautical radionavigation	160-190 FIXED MARITIME MOBILE US2	160-190 FIXED US2	
	190-200 AERONAUTICAL RADIONAVIGATION		190-200 AERONAUTICAL RADIONAVIGATION US18 US2		Aviation (87)
5.68 5.69 5.70	200-275 AERONAUTICAL RADIONAVIGATION Aeronautical mobile	200-285 AERONAUTICAL RADIONAVIGATION Aeronautical mobile	200-275 AERONAUTICAL RADIONAVIGATION US18 Aeronautical mobile US2		
255-283.5 BROADCASTING AERONAUTICAL RADIONAVIGATION	275-285 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Maritime radionavigation (radiobeacons)		275-285 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Maritime radionavigation (radiobeacons) US2 US18		
5.70 5.71					
283.5-315 AERONAUTICAL RADIONAVIGATION MARITIME RADIONAVIGATION (radiobeacons) 5.73	285-315 AERONAUTICAL RADIONAVIGATION MARITIME RADIONAVIGATION (radiobeacons) 5.73		285-325 MARITIME RADIONAVIGATION (radiobeacons) 5.73 Aeronautical radionavigation (radiobeacons)		
5.74					
315-325 AERONAUTICAL RADIONAVIGATION Maritime radionavigation (radiobeacons) 5.73	315-325 MARITIME RADIONAVIGATION (radiobeacons) 5.73 Aeronautical radionavigation	315-325 AERONAUTICAL RADIONAVIGATION MARITIME RADIONAVIGATION (radiobeacons) 5.73			
5.75			US2 US18 US364		
325-405 AERONAUTICAL RADIONAVIGATION	325-335 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Maritime radionavigation (radiobeacons)	325-405 AERONAUTICAL RADIONAVIGATION Aeronautical mobile	325-335 AERONAUTICAL RADIONAVIGATION (radiobeacons) Aeronautical mobile Maritime radionavigation (radiobeacons) US2 US18		Aviation (87)
	335-405 AERONAUTICAL RADIONAVIGATION Aeronautical mobile		335-405 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 Aeronautical mobile US2		
405-415 RADIONAVIGATION 5.76	405-415 RADIONAVIGATION 5.76 Aeronautical mobile		405-415 RADIONAVIGATION 5.76 US18 Aeronautical mobile US2		Maritime (80) Aviation (87)
415-435 MARITIME MOBILE 5.79 AERONAUTICAL RADIONAVIGATION	415-472 MARITIME MOBILE 5.79 Aeronautical radionavigation 5.77 5.80		415-435 MARITIME MOBILE 5.79 AERONAUTICAL RADIONAVIGATION US2		



435-472 MARITIME MOBILE 5.79 Aeronautical radionavigation 5.77			435-472 MARITIME MOBILE 5.79 Aeronautical radionavigation	435-472 MARITIME MOBILE 5.79	
5.82	5.78 5.82		5.82 US2 US231	5.82 US2 US231	
472-479 MARITIME MOBILE 5.79 Amateur 5.80A Aeronautical radionavigation 5.77 5.80			472-479	472-479 Amateur 5.80A	Amateur Radio (97)
5.80B 5.82			US2	5.82 US2 NG8	
479-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation 5.77	479-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation 5.77 5.80		479-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation	479-495 MARITIME MOBILE 5.79 5.79A	Maritime (80)
5.82	5.82		5.82 US2 US231	5.82 US2 US231	
495-505 MARITIME MOBILE			495-505 MARITIME MOBILE		Maritime (80) Aviation (87)
505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION	505-510 MARITIME MOBILE 5.79	505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Land mobile	505-510 MARITIME MOBILE 5.79		Maritime (80)
	510-525 MARITIME MOBILE 5.79A 5.84 AERONAUTICAL RADIONAVIGATION		510-525 MARITIME MOBILE (ships only) 5.79A 5.84 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 US14 US225		Maritime (80) Aviation (87)
526.5-1606.5 BROADCASTING	525-535 BROADCASTING 5.86 AERONAUTICAL RADIONAVIGATION	526.5-535 BROADCASTING Mobile 5.88	525-535 MOBILE US221 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 US239		Aviation (87) Private Land Mobile (90)
	535-1605 BROADCASTING	535-1606.5 BROADCASTING	535-1605	535-1605 BROADCASTING NG1 NG5	Radio Broadcast (AM)(73) Private Land Mobile (90)
5.87 5.87A	1605-1625 BROADCASTING 5.89	1606.5-1800 FIXED MOBILE RADIOLOCATION RADIONAVIGATION	1605-1615 MOBILE US221 G127	1605-1705 BROADCASTING 5.89	Radio Broadcast (AM)(73) Alaska Fixed (80) Private Land Mobile (90)
5.92	5.90		1615-1705		
1625-1635 RADIOLOCATION	1625-1705 FIXED MOBILE				
5.93	BROADCASTING 5.89 Radiolocation				
1635-1800 FIXED MARITIME MOBILE 5.90 LAND MOBILE	5.90		US299	US299 NG1 NG5	
5.92 5.96	1705-1800 FIXED MOBILE RADIOLOCATION AERONAUTICAL RADIONAVIGATION	5.91	1705-1800 FIXED MOBILE RADIOLOCATION US240		Alaska Fixed (80) Private Land Mobile (90)

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2194-2300 FIXED MOBILE except aeronautical mobile (R)  5.92 5.103 5.112	2194-2300 FIXED MOBILE  5.112	2194-2495 FIXED MOBILE	2194-2495 FIXED MOBILE except aeronautical mobile	Maritime (80) Private Land Mobile (90)
2300-2498 FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113	2300-2495 FIXED MOBILE BROADCASTING 5.113	US22 US340	US22 US340 NG7	
5.103 2498-2501 STANDARD FREQUENCY AND TIME SIGNAL (2500 kHz)	2495-2501 STANDARD FREQUENCY AND TIME SIGNAL (2500 kHz)	2495-2505 STANDARD FREQUENCY AND TIME SIGNAL (2500 kHz)		
2501-2502 STANDARD FREQUENCY AND TIME SIGNAL Space research				
2502-2625 FIXED MOBILE except aeronautical mobile (R)	2502-2505 STANDARD FREQUENCY AND TIME SIGNAL	US1 US340		
5.92 5.103 5.114 2625-2650 MARITIME MOBILE MARITIME RADIONAVIGATION	2505-2850 FIXED MOBILE	2505-2850 FIXED MOBILE US285	2505-2850 FIXED MOBILE except aeronautical mobile US285	Maritime (80) Aviation (87) Private Land Mobile (90)
5.92 2650-2850 FIXED MOBILE except aeronautical mobile (R)		US22 US340	US22 US340	
5.92 5.103 2850-3025 AERONAUTICAL MOBILE (R)		2850-3025 AERONAUTICAL MOBILE (R)		Aviation (87)
5.111 5.115 3025-3155 AERONAUTICAL MOBILE (OR)		5.111 5.115 US283 US340 3025-3155 AERONAUTICAL MOBILE (OR)		
3155-3200 FIXED MOBILE except aeronautical mobile (R)		US340 3155-3230 FIXED MOBILE except aeronautical mobile (R)		Maritime (80) Private Land Mobile (90)
5.116 5.117 3200-3230 FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113				
5.116		US22 US340		Page 6

Table of Frequency Allocations			3.23-5.73 MHz (HF)		Page 7
International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
3.23-3.4 FIXED MOBILE except aeronautical mobile BROADCASTING 5.113 5.116 5.118			3.23-3.4 FIXED MOBILE except aeronautical mobile Radiolocation US340		Maritime (80) Aviation (87) Private Land Mobile (90)
3.4-3.5 AERONAUTICAL MOBILE (R)			3.4-3.5 AERONAUTICAL MOBILE (R) US283 US340		Aviation (87)
3.5-3.8 AMATEUR FIXED MOBILE except aeronautical mobile 5.92	3.5-3.75 AMATEUR 5.119	3.5-3.9 AMATEUR FIXED MOBILE	3.5-4	3.5-4 AMATEUR	Amateur Radio (97)
3.8-3.9 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	3.75-4 AMATEUR FIXED MOBILE except aeronautical mobile (R)				
3.9-3.95 AERONAUTICAL MOBILE (OR) 5.123		3.9-3.95 AERONAUTICAL MOBILE BROADCASTING			
3.95-4 FIXED BROADCASTING		3.95-4 FIXED BROADCASTING			
	5.122 5.125	5.126	US340	US340	
4-4.063 FIXED MARITIME MOBILE 5.127 5.126			4-4.063 FIXED MARITIME MOBILE US340		Maritime (80)
4.063-4.438 MARITIME MOBILE 5.79A 5.109 5.110 5.130 5.131 5.132 5.128			4.063-4.438 MARITIME MOBILE 5.79A 5.109 5.110 5.130 5.131 5.132 US82 US296 US340		Maritime (80) Aviation (87)
4.438-4.488 FIXED MOBILE except aeronautical mobile (R) Radiolocation 5.132A 5.132B	4.438-4.488 FIXED MOBILE except aeronautical mobile (R) RADIOLOCATION 5.132A	4.438-4.488 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	4.438-4.488 FIXED MOBILE except aeronautical mobile (R) RADIOLOCATION 5.132A US340		Maritime (80) Private Land Mobile (90)
4.488-4.65 FIXED MOBILE except aeronautical mobile (R)		4.488-4.65 FIXED MOBILE except aeronautical mobile	4.488-4.65 FIXED MOBILE except aeronautical mobile (R) US22 US340		Maritime (80) Aviation (87) Private Land Mobile (90)
4.65-4.7 AERONAUTICAL MOBILE (R)			4.65-4.7 AERONAUTICAL MOBILE (R) US282 US283 US340		Aviation (87)
4.7-4.75 AERONAUTICAL MOBILE (OR)			4.7-4.75 AERONAUTICAL MOBILE (OR) US340		

4.75-4.85 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE BROADCASTING 5.113	4.75-4.85 FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113	4.75-4.85 FIXED BROADCASTING 5.113 Land mobile	4.75-4.85 FIXED MOBILE except aeronautical mobile (R)  US340		Maritime (80) Private Land Mobile (90)
4.85-4.995 FIXED LAND MOBILE BROADCASTING 5.113			4.85-4.995 FIXED MOBILE US340	4.85-4.995 FIXED  US340	Aviation (87) Private Land Mobile (90)
4.995-5.003 STANDARD FREQUENCY AND TIME SIGNAL (5 MHz)			4.995-5.005 STANDARD FREQUENCY AND TIME SIGNAL (5 MHz)  US1 US340		
5.003-5.005 STANDARD FREQUENCY AND TIME SIGNAL Space research					
5.005-5.06 FIXED BROADCASTING 5.113			5.005-5.06 FIXED US22 US340		Aviation (87) Private Land Mobile (90)
5.06-5.25 FIXED Mobile except aeronautical mobile 5.133			5.06-5.25 FIXED US22 Mobile except aeronautical mobile US212 US340		Maritime (80) Aviation (87) Private Land Mobile (90)
5.25-5.275 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A 5.133A	5.25-5.275 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A	5.25-5.275 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	5.25-5.275 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A US340		Maritime (80) Private Land Mobile (90)
5.275-5.3515 FIXED MOBILE except aeronautical mobile			5.275-5.45 FIXED US22 Mobile except aeronautical mobile  US23 US340		Maritime (80) Aviation (87) Private Land Mobile (90) Amateur Radio (97)
5.3515-5.3665 FIXED MOBILE except aeronautical mobile Amateur 5.133B					
5.3665-5.45 FIXED MOBILE except aeronautical mobile					
5.45-5.48 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	5.45-5.48 AERONAUTICAL MOBILE (R)	5.45-5.48 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	5.45-5.68 AERONAUTICAL MOBILE (R)		Aviation (87)
5.48-5.68 AERONAUTICAL MOBILE (R)			5.111 5.115 US283 US340		
5.111 5.115					
5.68-5.73 AERONAUTICAL MOBILE (OR)			5.68-5.73 AERONAUTICAL MOBILE (OR)		
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5.9-5.95 BROADCASTING 5.134 5.136 5.95-6.2 BROADCASTING			5.9-6.2 BROADCASTING 5.134  US136 US340		International Broadcast Stations (73F)
6.2-6.525 MARITIME MOBILE 5.109 5.110 5.130 5.132 5.137			6.2-6.525 MARITIME MOBILE 5.109 5.110 5.130 5.132 US82 US296 US340		Maritime (80)
6.525-6.685 AERONAUTICAL MOBILE (R)			6.525-6.685 AERONAUTICAL MOBILE (R) US283 US340		Aviation (87)
6.685-6.765 AERONAUTICAL MOBILE (OR)			6.685-6.765 AERONAUTICAL MOBILE (OR) US340		
6.765-7 FIXED MOBILE except aeronautical mobile (R) 5.138			6.765-7 FIXED US22 MOBILE except aeronautical mobile (R) 5.138 US340		ISM Equipment (18) Private Land Mobile (90)
7-7.1 AMATEUR AMATEUR-SATELLITE 5.140 5.141 5.141A			7-7.2	7-7.1 AMATEUR AMATEUR-SATELLITE US340	Amateur Radio (97)
7.1-7.2 AMATEUR 5.142 5.141A 5.141B			US340	7.1-7.2 AMATEUR US340	
7.2-7.3 BROADCASTING	7.2-7.3 AMATEUR 5.142	7.2-7.3 BROADCASTING	7.2-7.3  US142 US340	7.2-7.3 AMATEUR US142 US340	International Broadcast Stations (73F) Amateur Radio (97)
7.3-7.4 BROADCASTING 5.134 5.143 5.143A 5.143B 5.143C 5.143D			7.3-7.4 BROADCASTING 5.134 US136 US340		International Broadcast Stations (73F) Maritime (80) Private Land Mobile (90)
7.4-7.45 BROADCASTING  5.143B 5.143C	7.4-7.45 FIXED MOBILE except aeronautical mobile (R)	7.4-7.45 BROADCASTING  5.143A 5.143C	7.4-7.45 FIXED MOBILE except aeronautical mobile (R) US142 US340		
7.45-8.1 FIXED MOBILE except aeronautical mobile (R) 5.144			7.45-8.1 FIXED US22 MOBILE except aeronautical mobile (R) US340		Maritime (80) Aviation (87) Private Land Mobile (90)

8.1-8.195 FIXED MARITIME MOBILE			8.1-8.195 FIXED MARITIME MOBILE US340	Maritime (80)
8.195-8.815 MARITIME MOBILE 5.109 5.110 5.132 5.145 5.111			8.195-8.815 MARITIME MOBILE 5.109 5.110 5.132 5.145 US82 5.111 US296 US340	Maritime (80) Aviation (87)
8.815-8.965 AERONAUTICAL MOBILE (R)			8.815-8.965 AERONAUTICAL MOBILE (R) US340	Aviation (87)
8.965-9.04 AERONAUTICAL MOBILE (OR)			8.965-9.04 AERONAUTICAL MOBILE (OR) US340	
9.04-9.305 FIXED	9.04-9.4 FIXED	9.04-9.305 FIXED	9.04-9.4 FIXED    US340	Maritime (80) Private Land Mobile (90)
9.305-9.355 FIXED Radiolocation 5.145A		9.305-9.355 FIXED Radiolocation 5.145A		
5.145B				
9.355-9.4 FIXED		9.355-9.4 FIXED		
9.4-9.5 BROADCASTING 5.134 5.146			9.4-9.9 BROADCASTING 5.134   US136 US340	International Broadcast Stations (73F)
9.5-9.9 BROADCASTING 5.147				
9.9-9.995 FIXED				
9.995-10.003 STANDARD FREQUENCY AND TIME SIGNAL (10 MHz) 5.111			9.995-10.005 STANDARD FREQUENCY AND TIME SIGNAL (10 MHz)   5.111 US1 US340	
10.003-10.005 STANDARD FREQUENCY AND TIME SIGNAL Space research 5.111				
10.005-10.1 AERONAUTICAL MOBILE (R) 5.111				
10.1-10.15 FIXED Amateur			10.1-10.15 AMATEUR US247 US340	Aviation (87)  Amateur Radio (97)
10.15-11.175 FIXED Mobile except aeronautical mobile (R)			10.15-11.175 FIXED Mobile except aeronautical mobile (R)  US340	Private Land Mobile (90)

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11.175-11.275 AERONAUTICAL MOBILE (OR)			11.175-11.275 AERONAUTICAL MOBILE (OR)  US340		
11.275-11.4 AERONAUTICAL MOBILE (R)			11.275-11.4 AERONAUTICAL MOBILE (R)  US283 US340		Aviation (87)
11.4-11.6 FIXED			11.4-11.6 FIXED  US340		Private Land Mobile (90)
11.6-11.65 BROADCASTING 5.134			11.6-12.1 BROADCASTING 5.134    US136 US340		International Broadcast Stations (73F)
5.146					
11.65-12.05 BROADCASTING					
5.147					
12.05-12.1 BROADCASTING 5.134			12.1-12.23 FIXED  US340		Private Land Mobile (90)
5.146					
12.1-12.23 FIXED			12.23-13.2 MARITIME MOBILE 5.109 5.110 5.132 5.145  US296 US340		Maritime (80)
12.23-13.2 MARITIME MOBILE 5.109 5.110 5.132 5.145			13.2-13.26 AERONAUTICAL MOBILE (OR)  US340		
13.2-13.26 AERONAUTICAL MOBILE (OR)			13.26-13.36 AERONAUTICAL MOBILE (R)  US283 US340		Aviation (87)
13.26-13.36 AERONAUTICAL MOBILE (R)			13.36-13.41 FIXED RADIO ASTRONOMY  US342 G115	13.36-13.41 RADIO ASTRONOMY  US342	
13.36-13.41 FIXED RADIO ASTRONOMY			13.41-13.45 FIXED Mobile except aeronautical mobile (R)  US340	13.41-13.45 FIXED  US340	Private Land Mobile (90)
5.149					



13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A 5.149A	13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A	13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A US340	13.45-13.55 FIXED Radiolocation 5.132A US340	
13.55-13.57 FIXED Mobile except aeronautical mobile (R) 5.150		13.55-13.57 FIXED Mobile except aeronautical mobile (R) 5.150 US340	13.55-13.57 FIXED 5.150 US340	ISM Equipment (18) Private Land Mobile (90)
13.57-13.6 BROADCASTING 5.134 5.151		13.57-13.87 BROADCASTING 5.134  US136 US340		International Broadcast Stations (73F)
13.6-13.8 BROADCASTING				
13.8-13.87 BROADCASTING 5.134 5.151				
13.87-14 FIXED Mobile except aeronautical mobile (R)		13.87-14 FIXED Mobile except aeronautical mobile (R) US340	13.87-14 FIXED US340	Private Land Mobile (90)
14-14.25 AMATEUR AMATEUR-SATELLITE		14-14.35  US340	14-14.25 AMATEUR AMATEUR-SATELLITE US340	Amateur Radio (97)
14.25-14.35 AMATEUR			14.25-14.35 AMATEUR	
5.152			US340	
14.35-14.99 FIXED Mobile except aeronautical mobile (R)		14.35-14.99 FIXED Mobile except aeronautical mobile (R) US340	14.35-14.99 FIXED US340	Private Land Mobile (90)
14.99-15.005 STANDARD FREQUENCY AND TIME SIGNAL (15 MHz) 5.111		14.99-15.01 STANDARD FREQUENCY AND TIME SIGNAL (15 MHz)  5.111 US1 US340		
15.005-15.01 STANDARD FREQUENCY AND TIME SIGNAL Space research				
15.01-15.1 AERONAUTICAL MOBILE (OR)				
		US340		

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15.1-15.6 BROADCASTING			15.1-15.8 BROADCASTING 5.134		International Broadcast Stations (73F)
15.6-15.8 BROADCASTING 5.134			US136 US340		
5.146			15.8-16.1 FIXED		Private Land Mobile (90)
15.8-16.1 FIXED			US340		
5.153			16.1-16.2 FIXED		
16.1-16.2 FIXED Radiolocation 5.145A	16.1-16.2 FIXED RADIOLOCATION 5.145A	16.1-16.2 FIXED Radiolocation 5.145A	RADIOLOCATION 5.145A		
5.145B			US340		
16.2-16.36 FIXED			16.2-16.36 FIXED		
			US340		
16.36-17.41 MARITIME MOBILE 5.109 5.110 5.132 5.145			16.36-17.41 MARITIME MOBILE 5.109 5.110 5.132 5.145 US82		Maritime (80)
			US296 US340		
17.41-17.48 FIXED			17.41-17.48 FIXED		Private Land Mobile (90)
			US340		
17.48-17.55 BROADCASTING 5.134			17.48-17.9 BROADCASTING 5.134		International Broadcast Stations (73F)
5.146			US136 US340		
17.55-17.9 BROADCASTING			17.9-17.97 AERONAUTICAL MOBILE (R)		Aviation (87)
17.9-17.97 AERONAUTICAL MOBILE (R)			US283 US340		
17.97-18.03 AERONAUTICAL MOBILE (OR)			17.97-18.03 AERONAUTICAL MOBILE (OR)		
			US340		
18.030-18.052 FIXED			18.03-18.068 FIXED		Maritime (80) Private Land Mobile (90)
18.052-18.068 FIXED					
Space research			US340		
18.068-18.168 AMATEUR AMATEUR-SATELLITE			18.068-18.168	18.068-18.168 AMATEUR AMATEUR-SATELLITE	Amateur Radio (97)
5.154			US340	US340	
18.168-18.78 FIXED Mobile except aeronautical mobile			18.168-18.78 FIXED Mobile		Maritime (80) Private Land Mobile (90)
			US340		

18.78-18.9 MARITIME MOBILE	18.78-18.9 MARITIME MOBILE US82  US296 US340	Maritime (80)
18.9-19.02 BROADCASTING 5.134  5.146	18.9-19.02 BROADCASTING 5.134  US136 US340	International Broadcast Stations (73F)
19.02-19.68 FIXED	19.02-19.68 FIXED  US340	Private Land Mobile (90)
19.68-19.8 MARITIME MOBILE 5.132	19.68-19.8 MARITIME MOBILE 5.132  US340	Maritime (80)
19.8-19.99 FIXED	19.8-19.99 FIXED  US340	Private Land Mobile (90)
19.99-19.995 STANDARD FREQUENCY AND TIME SIGNAL Space research  5.111	19.99-20.01 STANDARD FREQUENCY AND TIME SIGNAL (20 MHz)  5.111 US1 US340	Private Land Mobile (90)
19.995-20.01 STANDARD FREQUENCY AND TIME SIGNAL (20 MHz)  5.111		
20.01-21 FIXED Mobile	20.01-21 FIXED Mobile  US340	Private Land Mobile (90)
21-21.45 AMATEUR AMATEUR-SATELLITE	21-21.45  US340	Amateur Radio (97)
21.45-21.85 BROADCASTING	21.45-21.85 BROADCASTING  US340	International Broadcast Stations (73F)
21.85-21.87 FIXED 5.155A  5.155	21.85-21.924 FIXED  US340	Aviation (87) Private Land Mobile (90)
21.87-21.924 FIXED 5.155B		
21.924-22 AERONAUTICAL MOBILE (R)	21.924-22 AERONAUTICAL MOBILE (R)  US340	Aviation (87)
22-22.855 MARITIME MOBILE 5.132  5.156	22-22.855 MARITIME MOBILE 5.132 US82  US296 US340	Maritime (80)

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Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
22.855-23 FIXED			22.855-23 FIXED		Private Land Mobile (90)
5.156			US340		
23-23.2 FIXED Mobile except aeronautical mobile (R)			23-23.2 FIXED Mobile except aeronautical mobile (R)	23-23.2 FIXED	
5.156			US340	US340	
23.2-23.35 FIXED 5.156A AERONAUTICAL MOBILE (OR)			23.2-23.35 AERONAUTICAL MOBILE (OR)		
			US340		
23.35-24 FIXED MOBILE except aeronautical mobile 5.157			23.35-24.45 FIXED MOBILE except aeronautical mobile	23.35-24.45 FIXED	Private Land Mobile (90)
24-24.45 FIXED LAND MOBILE			US340	US340	
24.45-24.6 FIXED LAND MOBILE Radiolocation 5.132A	24.45-24.65 FIXED LAND MOBILE RADIOLOCATION 5.132A	24.45-24.6 FIXED LAND MOBILE Radiolocation 5.132A	24.45-24.65 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A	24.45-24.65 FIXED RADIOLOCATION 5.132A	
5.158			US340	US340	
24.6-24.89 FIXED LAND MOBILE	24.65-24.89 FIXED LAND MOBILE	24.6-24.89 FIXED LAND MOBILE	24.65-24.89 FIXED MOBILE except aeronautical mobile	24.65-24.89 FIXED	
			US340	US340	
24.89-24.99 AMATEUR AMATEUR-SATELLITE			24.89-24.99	24.89-24.99 AMATEUR AMATEUR-SATELLITE	Amateur Radio (97)
			US340	US340	
24.99-25.005 STANDARD FREQUENCY AND TIME SIGNAL (25 MHz)			24.99-25.01 STANDARD FREQUENCY AND TIME SIGNAL (25 MHz)		
25.005-25.01 STANDARD FREQUENCY AND TIME SIGNAL Space research			US1 US340		
25.01-25.07 FIXED MOBILE except aeronautical mobile			25.01-25.07	25.01-25.07 LAND MOBILE	Private Land Mobile (90)
			US340	US340 NG112	
25.07-25.21 MARITIME MOBILE			25.07-25.21 MARITIME MOBILE US82	25.07-25.21 MARITIME MOBILE US82	Maritime (80) Private Land Mobile (90)
			US281 US296 US340	US281 US296 US340 NG112	

25.21-25.55 FIXED MOBILE except aeronautical mobile			25.21-25.33  US340	25.21-25.33 LAND MOBILE  US340	Private Land Mobile (90)
			25.33-25.55 FIXED MOBILE except aeronautical mobile  US340	25.33-25.55   US340	
25.55-25.67 RADIO ASTRONOMY  5.149			25.55-25.67 RADIO ASTRONOMY US74  US342		
25.67-26.1 BROADCASTING			25.67-26.1 BROADCASTING  US25 US340		International Broadcast Stations (73F) Remote Pickup (74D)
26.1-26.175 MARITIME MOBILE 5.132			26.1-26.175 MARITIME MOBILE 5.132  US25 US340		Remote Pickup (74D) Low Power Auxiliary (74H) Maritime (80)
26.175-26.2 FIXED MOBILE except aeronautical mobile			26.175-26.2  US340	26.175-26.2 LAND MOBILE  US340	Remote Pickup (74D) Low Power Auxiliary (74H)
26.2-26.35 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A 5.133A	26.2-26.42 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A	26.2-26.35 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	26.2-26.42 RADIOLOCATION US132A  US340	26.2-26.42 LAND MOBILE RADIOLOCATION US132A  US340	Remote Pickup (74D) Low Power Auxiliary (74H) Private Land Mobile (90)
26.35-27.5 FIXED MOBILE except aeronautical mobile	26.42-27.5 FIXED MOBILE except aeronautical mobile	26.35-27.5 FIXED MOBILE except aeronautical mobile	26.42-26.48  US340	26.42-26.48 LAND MOBILE  US340	Remote Pickup (74D) Low Power Auxiliary (74H)
			26.48-26.95 FIXED MOBILE except aeronautical mobile US340	26.48-26.95  US340	
			26.95-27.41  5.150 US340	26.95-26.96 FIXED 5.150 US340 26.96-27.23 MOBILE except aeronautical mobile 5.150 US340	ISM Equipment (18)
				27.23-27.41 FIXED MOBILE except aeronautical mobile 5.150 US340	ISM Equipment (18) Private Land Mobile (90) Personal Radio (95)
5.150	5.150	5.150			

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27.5-28 METEOROLOGICAL AIDS FIXED MOBILE			US340	US340	
			27.54-28 FIXED MOBILE US298 US340	27.54-28 US298 US340	
28-29.7 AMATEUR AMATEUR-SATELLITE			28-29.7  US340	28-29.7 AMATEUR AMATEUR-SATELLITE US340	Amateur Radio (97)
29.7-30.005 FIXED MOBILE			29.7-29.89	29.7-29.8 LAND MOBILE US340	Private Land Mobile (90)
				29.8-29.89 FIXED US340	
			29.89-29.91 FIXED MOBILE US340	29.89-29.91 US340	
			29.91-30  US340	29.91-30 FIXED US340	
			30-30.56 FIXED MOBILE	30-30.56	
			30.56-32	30.56-32 FIXED LAND MOBILE NG124	Private Land Mobile (90)
			32-33 FIXED MOBILE	32-33	
30.005-30.01 SPACE OPERATION (satellite identification) FIXED MOBILE SPACE RESEARCH			33-34	33-34 FIXED LAND MOBILE NG124	Private Land Mobile (90)
30.01-37.5 FIXED MOBILE					

			34-35 FIXED MOBILE	34-35	
			35-36	35-36 FIXED LAND MOBILE	Public Mobile (22) Private Land Mobile (90)
			36-37 FIXED MOBILE	36-37	
			US220	US220	
			37-37.5	37-37.5 LAND MOBILE NG124	Private Land Mobile (90)
37.5-38.25 FIXED MOBILE Radio astronomy			37.5-38 Radio astronomy US342	37.5-38 LAND MOBILE Radio astronomy US342 NG59 NG124	
			38-38.25 FIXED MOBILE RADIO ASTRONOMY US81 US342	38-38.25 RADIO ASTRONOMY US81 US342	
5.149	38.25-39.986 FIXED MOBILE	38.25-39.5 FIXED MOBILE	38.25-39 FIXED MOBILE	38.25-39	
38.25-39 FIXED MOBILE					
39-39.5 FIXED MOBILE Radiolocation 5.132A					
5.159		39.5-39.986 FIXED MOBILE RADIOLOCATION 5.132A	39-40	39-40 LAND MOBILE NG124	Private Land Mobile (90)
39.5-39.986 FIXED MOBILE					
39.986-40.02 FIXED MOBILE Space research		39.986-40 FIXED MOBILE RADIOLOCATION 5.132A Space research			
		40-40.02 FIXED MOBILE Space research	40-41.015 FIXED MOBILE	40-41.015	ISM Equipment (18) Private Land Mobile (90)
40.02-40.98 FIXED MOBILE					
5.150			5.150 US210 US220	5.150 US210 US220	

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
40.98-41.015 FIXED MOBILE Space research 5.160 5.161			(See previous page)		
41.015-42 FIXED MOBILE			41.015-41.665 FIXED MOBILE RADIOLOCATION US132A US220	41.015-41.665 RADIOLOCATION US132A US220	Private Land Mobile (90)
5.160 5.161 5.161A			41.665-42 FIXED MOBILE US220	41.665-42 US220	
42-42.5 FIXED MOBILE Radiolocation 5.132A	42-42.5 FIXED MOBILE		42-43.35	42-43.35 FIXED LAND MOBILE	Public Mobile (22) Private Land Mobile (90)
5.160 5.161B	5.161			NG124 NG141	
42.5-44 FIXED MOBILE			43.35-44 RADIOLOCATION US132A	43.35-43.69 FIXED LAND MOBILE RADIOLOCATION US132A NG124	Private Land Mobile (90)
5.160 5.161 5.161A				43.69-44 LAND MOBILE RADIOLOCATION US132A NG124	
44-47 FIXED MOBILE			44-46.6	44-46.6 LAND MOBILE NG124 NG141	
			46.6-47 FIXED MOBILE	46.6-47	
5.162 5.162A			47-49.6	47-49.6 LAND MOBILE NG124	Private Land Mobile (90)
47-68 BROADCASTING	47-50 FIXED MOBILE	47-50 FIXED MOBILE BROADCASTING	49.6-50 FIXED MOBILE	49.6-50	
		5.162A			
	50-54 AMATEUR 5.162A 5.167 5.167A 5.168 5.170		50-73	50-54 AMATEUR	Amateur Radio (97)



5.162A 5.163 5.164 5.165 5.169 5.171 68-74.8 FIXED MOBILE except aeronautical mobile	54-68 BROADCASTING Fixed Mobile	54-68 FIXED MOBILE BROADCASTING	54-72 BROADCASTING    NG5 NG14 NG115 NG149  72-73 FIXED MOBILE  NG3 NG16 NG56		Broadcast Radio (TV)(73) LPTV, TV Translator/ Booster (74G) Low Power Auxiliary (74H)		
	5.172	5.162A					
	68-72 BROADCASTING Fixed Mobile	68-74.8 FIXED MOBILE			Public Mobile (22) Maritime (80) Aviation (87) Private Land Mobile (90) Personal Radio (95)		
	5.173						
	72-73 FIXED MOBILE						
5.149 5.175 5.177 5.179 74.8-75.2 AERONAUTICAL RADIONAVIGATION 5.180 5.181 75.2-87.5 FIXED MOBILE except aeronautical mobile	73-74.6 RADIO ASTRONOMY 5.178		73-74.6 RADIO ASTRONOMY US74 US246				
	74.6-74.8 FIXED MOBILE		74.6-74.8 FIXED MOBILE US273		Private Land Mobile (90)		
		5.149 5.176 5.179	74.8-75.2 AERONAUTICAL RADIONAVIGATION 5.180		Aviation (87)		
			75.2-75.4 FIXED MOBILE US273		Private Land Mobile (90)		
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				940-941 FIXED MOBILE US116 US268	Personal Communications (24)
942-960 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.323	942-960 FIXED MOBILE 5.317A	942-960 FIXED MOBILE 5.317A BROADCASTING 5.320	941-944 FIXED US84 US268 US301 G2	941-944 FIXED US84 US268 US301 NG30 NG35	Public Mobile (22) Aural Broadcast Auxiliary (74E) Low Power Auxiliary (74H) Fixed Microwave (101)
			944-960	944-960 FIXED NG35	
960-1164 AERONAUTICAL MOBILE (R) 5.327A AERONAUTICAL RADIONAVIGATION 5.328 5.328AA			960-1164 AERONAUTICAL MOBILE (R) 5.327A AERONAUTICAL RADIONAVIGATION 5.328 US224		Aviation (87)
1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.328A			1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328A US224		
1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active) 5.330 5.331 5.332			1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) G132 SPACE RESEARCH (active) 5.332	1215-1240 Earth exploration-satellite (active) Space research (active)	
1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active) Amateur 5.282 5.330 5.331 5.332 5.335 5.335A			1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 SPACE RESEARCH (active) AERONAUTICAL RADIONAVIGATION 5.332 5.335	1240-1300 AERONAUTICAL RADIONAVIGATION Amateur Earth exploration-satellite (active) Space research (active) 5.282	Amateur Radio (97)
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1350-1400 FIXED MOBILE RADIOLOCATION	1350-1400 RADIOLOCATION 5.338A		1350-1390 FIXED MOBILE RADIOLOCATION G2 5.334 5.339 US342 US385 G27 G114	1350-1390 5.334 5.339 US342 US385	
			1390-1395 5.339 US79 US342 US385	1390-1395 FIXED MOBILE except aeronautical mobile 5.339 US79 US342 US385 NG338A	Wireless Communications (27)
5.149 5.338 5.338A 5.339	5.149 5.334 5.339		1395-1400 LAND MOBILE (medical telemetry and medical telecommand) 5.339 US79 US342 US385		Personal Radio (95)

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1427-1429 SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 5.341A 5.341B 5.341C 5.338A 5.341			1427-1429.5 LAND MOBILE (medical telemetry and medical telecommand) US350	1427-1429.5 LAND MOBILE (telemetry and telecommand) Fixed (telemetry)	Private Land Mobile (90) Personal Radio (95)
1429-1452 FIXED MOBILE except aeronautical mobile 5.341A	1429-1452 FIXED MOBILE 5.341B 5.341C 5.343		5.341 US79 1429.5-1432	5.341 US79 US350 NG338A 1429.5-1432 FIXED (telemetry and telecommand) LAND MOBILE (telemetry and telecommand)	
			5.341 US79 US350 1432-1435	5.341 US79 US350 NG338A 1432-1435 FIXED MOBILE except aeronautical mobile	
5.338A 5.341 5.342	5.338A 5.341		5.341 US83 1435-1525 MOBILE (aeronautical telemetry) US338A	5.341 US83 NG338A	Wireless Communications (27)
1452-1492 FIXED MOBILE except aeronautical mobile 5.346 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.342 5.345	1452-1492 FIXED MOBILE 5.341B 5.343 5.346A BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.344 5.345				
1492-1518 FIXED MOBILE except aeronautical mobile 5.341A	1492-1518 FIXED MOBILE 5.341B 5.343	1492-1518 FIXED MOBILE 5.341C			Aviation (87)
5.341 5.342	5.341 5.344	5.341			
1518-1525 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A	1518-1525 FIXED MOBILE 5.343 MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A	1518-1525 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A			
5.341 5.342	5.341 5.344	5.341	5.341 US84 US343		

1525-1530 SPACE OPERATION (space-to-Earth) FIXED MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A Earth exploration-satellite Mobile except aeronautical mobile 5.349 5.341 5.342 5.350 5.351 5.352A 5.354	1525-1530 SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A Earth exploration-satellite Fixed Mobile 5.343 5.341 5.351 5.354	1525-1530 SPACE OPERATION (space-to-Earth) FIXED MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A Earth exploration-satellite Mobile 5.349 5.341 5.351 5.352A 5.354	1525-1535 MOBILE-SATELLITE (space-to-Earth) US315 US380 5.341 5.351	Satellite Communications (25) Maritime (80)
1530-1535 SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A 5.353A Earth exploration-satellite Fixed Mobile except aeronautical mobile 5.341 5.342 5.351 5.354	1530-1535 SPACE OPERATION (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A 5.353A Earth exploration-satellite Fixed Mobile 5.343 5.341 5.351 5.354			
1535-1559 MOBILE-SATELLITE (space-to-Earth) 5.208B 5.351A 5.341 5.351 5.353A 5.354 5.355 5.356 5.357 5.357A 5.359 5.362A			1535-1559 MOBILE-SATELLITE (space-to-Earth) US308 US309 US315 US380 5.341 5.351 5.356	Satellite Communications (25) Maritime (80) Aviation (87)
1559-1610 AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.208B 5.328B 5.329A 5.341			1559-1610 AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth)(space-to-space) 5.341 US85 US208 US260	Aviation (87)
1610-1610.6 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION 5.341 5.355 5.359 5.364 5.366 5.367 5.368 5.369 5.371 5.372	1610-1610.6 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) 5.341 5.364 5.366 5.367 5.368 5.370 5.372	1610-1610.6 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Radiodetermination-satellite (Earth-to-space) 5.341 5.355 5.359 5.364 5.366 5.367 5.368 5.369 5.372	1610-1610.6 MOBILE-SATELLITE (Earth-to-space) US319 US380 AERONAUTICAL RADIONAVIGATION US260 RADIODETERMINATION-SATELLITE (Earth-to-space) 5.341 5.364 5.366 5.367 5.368 5.372 US208	Satellite Communications (25) Aviation (87)
1610.6-1613.8 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY AERONAUTICAL RADIONAVIGATION 5.149 5.341 5.355 5.359 5.364 5.366 5.367 5.368 5.369 5.371 5.372	1610.6-1613.8 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) 5.149 5.341 5.364 5.366 5.367 5.368 5.370 5.372	1610.6-1613.8 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY AERONAUTICAL RADIONAVIGATION Radiodetermination-satellite (Earth-to-space) 5.149 5.341 5.355 5.359 5.364 5.366 5.367 5.368 5.369 5.372	1610.6-1613.8 MOBILE-SATELLITE (Earth-to-space) US319 US380 RADIO ASTRONOMY AERONAUTICAL RADIONAVIGATION US260 RADIODETERMINATION-SATELLITE (Earth-to-space) 5.341 5.364 5.366 5.367 5.368 5.372 US208 US342	
1613.8-1626.5 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B 5.341 5.355 5.359 5.364 5.365 5.366 5.367 5.368 5.369 5.371 5.372	1613.8-1626.5 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) Mobile-satellite (space-to-Earth) 5.208B 5.341 5.364 5.365 5.366 5.367 5.368 5.370 5.372	1613.8-1626.5 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B Radiodetermination-satellite (Earth-to-space) 5.341 5.355 5.359 5.364 5.365 5.366 5.367 5.368 5.369 5.372	1613.8-1626.5 MOBILE-SATELLITE (Earth-to-space) US319 US380 AERONAUTICAL RADIONAVIGATION US260 RADIODETERMINATION-SATELLITE (Earth-to-space) Mobile-satellite (space-to-Earth) 5.341 5.364 5.365 5.366 5.367 5.368 5.372 US208	

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1626.5-1660 MOBILE-SATELLITE (Earth-to-space) 5.351A			1626.5-1660 MOBILE-SATELLITE (Earth-to-space) US308 US309 US315 US380		Satellite Communications (25) Maritime (80) Aviation (87)
5.341 5.351 5.353A 5.354 5.355 5.357A 5.359 5.362A 5.374 5.375 5.376			5.341 5.351 5.375		
1660-1660.5 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY			1660-1660.5 MOBILE-SATELLITE (Earth-to-space) US308 US309 US380 RADIO ASTRONOMY		Satellite Communications (25) Aviation (87)
5.149 5.341 5.351 5.354 5.362A 5.376A			5.341 5.351 US342		
1660.5-1668 RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile			1660.5-1668.4 RADIO ASTRONOMY US74 SPACE RESEARCH (passive)		
5.149 5.341 5.379 5.379A					
1668-1668.4 MOBILE-SATELLITE (Earth-to-space) 5.351A 5.379B 5.379C RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile					
5.149 5.341 5.379 5.379A			5.341 US246		
1668.4-1670 METEOROLOGICAL AIDS FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (Earth-to-space) 5.351A 5.379B 5.379C RADIO ASTRONOMY			1668.4-1670 METEOROLOGICAL AIDS (radiosonde) RADIO ASTRONOMY US74		
5.149 5.341 5.379D 5.379E			5.341 US99 US342		
1670-1675 METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.379B			1670-1675	1670-1675 FIXED MOBILE except aeronautical mobile	Wireless Communications (27)
5.341 5.379D 5.379E 5.380A			5.341 US211 US362	5.341 US211 US362	
1675-1690 METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			1675-1695 METEOROLOGICAL AIDS (radiosonde) METEOROLOGICAL-SATELLITE (space-to-Earth) US88		
5.341			5.341 US211 US289		
1690-1700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) Fixed Mobile except aeronautical mobile	1690-1700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth)		1695-1710 METEOROLOGICAL-SATELLITE (space-to-Earth) US88	1695-1710 FIXED MOBILE except aeronautical mobile	Wireless Communications (27)
5.289 5.341 5.382	5.289 5.341 5.381				



1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile		1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile		
5.289 5.341		5.289 5.341 5.384	5.341	5.341 US88
1710-1930 FIXED MOBILE 5.384A 5.388A 5.388B			1710-1761	1710-1780 FIXED MOBILE
			5.341 US91 US378 US385	
			1761-1780 SPACE OPERATION (Earth-to-space) G42	
			US91	5.341 US91 US378 US385
			1780-1850 FIXED MOBILE SPACE OPERATION (Earth-to-space) G42	1780-1850
5.149 5.341 5.385 5.386 5.387 5.388			1850-2025	1850-2000 FIXED MOBILE
1930-1970 FIXED MOBILE 5.388A 5.388B	1930-1970 FIXED MOBILE 5.388A 5.388B Mobile-satellite (Earth-to-space)	1930-1970 FIXED MOBILE 5.388A 5.388B		RF Devices (15) Personal Communications (24) Wireless Communications (27) Fixed Microwave (101)
5.388	5.388	5.388		
1970-1980 FIXED MOBILE 5.388A 5.388B				
5.388				
1980-2010 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A				
5.388 5.389A 5.389B 5.389F				
2010-2025 FIXED MOBILE 5.388A 5.388B	2010-2025 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	2010-2025 FIXED MOBILE 5.388A 5.388B		Satellite Communications (25) Wireless Communications (27)
5.388	5.388 5.389C 5.389E	5.388		
2025-2110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space)			2025-2110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) SPACE RESEARCH (Earth-to-space) (space-to-space) FIXED MOBILE 5.391	2025-2110 FIXED NG118 MOBILE 5.391
5.392			5.392 US90 US92 US222 US346 US347	5.392 US90 US92 US222 US346 US347

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2110-2120 FIXED MOBILE 5.388A 5.388B SPACE RESEARCH (deep space) (Earth-to-space)			2110-2120	2110-2120 FIXED MOBILE	Public Mobile (22) Wireless Communications (27) Fixed Microwave (101)
5.388			US252	US252	
2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2160 FIXED MOBILE 5.388A 5.388B Mobile-satellite (space-to-Earth) 5.388	2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2200	2120-2180 FIXED MOBILE	
	2160-2170 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)				
5.388	5.388 5.389C 5.389E	5.388			
2170-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F				NG41 2180-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)	Satellite Communications (25) Wireless Communications (27)
2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)			2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) US96 EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED (line-of-sight only) MOBILE (line-of-sight only including aeronautical telemetry, but excluding flight testing of manned aircraft) 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)	2200-2290	
5.392			5.392 US303	US96 US303	
2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)			2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	2290-2300 SPACE RESEARCH (deep space) (space-to-Earth)	
2300-2450 FIXED MOBILE 5.384A Amateur Radiolocation	2300-2450 FIXED MOBILE 5.384A RADIOLOCATION Amateur		2300-2305 G122	2300-2305 Amateur	Amateur Radio (97)
			2305-2310	2305-2310 FIXED MOBILE except aeronautical mobile RADIOLOCATION Amateur	Wireless Communications (27) Amateur Radio (97)
			US97 G122	US97	

5.150 5.282 5.395 2450-2483.5 FIXED MOBILE Radiolocation	5.150 5.282 5.393 5.394 5.396	2310-2320 Fixed Mobile US100 Radiolocation G2	2310-2320 FIXED MOBILE BROADCASTING-SATELLITE RADIOLOCATION	Wireless Communications (27)
		US97 US327	5.396 US97 US100 US327	
		2320-2345 Fixed Radiolocation G2	2320-2345 BROADCASTING-SATELLITE	Satellite Communications (25)
		US327	5.396 US327	
		2345-2360 Fixed Mobile US100 Radiolocation G2	2345-2360 FIXED MOBILE US100 BROADCASTING-SATELLITE RADIOLOCATION	Wireless Communications (27)
		US327	5.396 US327	
		2360-2390 MOBILE US276 RADIOLOCATION G2 G120 Fixed	2360-2390 MOBILE US276	Aviation (87) Personal Radio (95)
		US101	US101	
		2390-2395 MOBILE US276	2390-2395 AMATEUR MOBILE US276	Aviation (87) Personal Radio (95) Amateur Radio (97)
		US101	US101	
5.150	5.150	2395-2400	2395-2400 AMATEUR	Personal Radio (95) Amateur Radio (97)
		US101 G122	US101	
		2400-2417	2400-2417 AMATEUR	RF Devices (15) ISM Equipment (18) Amateur Radio (97)
		5.150 G122	5.150 5.282	
5.150	5.150	2417-2450 Radiolocation G2	2417-2450 Amateur	
		5.150	5.150 5.282	
5.150	5.150	2450-2483.5	2450-2483.5 FIXED MOBILE Radiolocation	RF Devices (15) ISM Equipment (18) TV Auxiliary Broadcasting (74F) Private Land Mobile (90) Fixed Microwave (101)
		5.150 US41	5.150 US41	

International Table			United States Table		FCC Rule Part(s)
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2483.5-2500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 Radiolocation 5.398A	2483.5-2500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398	2483.5-2500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398	2483.5-2500 MOBILE-SATELLITE (space-to-Earth) US319 US380 US391 RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398	2483.5-2495 MOBILE-SATELLITE (space-to-Earth) US380 RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 5.150 5.402 US41 US319 NG147	ISM Equipment (18) Satellite Communications (25)
5.150 5.399 5.401 5.402	5.150 5.402	5.150 5.401 5.402	5.150 5.402 US41	2495-2500 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) US380 RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 5.150 5.402 US41 US319 US391 NG147	ISM Equipment (18) Satellite Communications (25) Wireless Communications (27)
2500-2520 FIXED 5.410 MOBILE except aeronautical mobile 5.384A	2500-2520 FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A	2500-2520 FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (space-to-Earth) 5.351A 5.407 5.414 5.414A	2500-2655	2500-2655 FIXED US205 MOBILE except aeronautical mobile	Wireless Communications (27)
5.412	5.404	5.404 5.415A			
2520-2655 FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416	2520-2655 FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416	2520-2535 FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 5.403 5.414A 5.415A			
5.339 5.412 5.418B 5.418C	5.339 5.418B 5.418C	5.339 5.418 5.418A 5.418B 5.418C	5.339 US205	5.339	
2655-2670 FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2655-2670 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2655-2670 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2655-2690 Earth exploration-satellite (passive) Radio astronomy US385 Space research (passive)	2655-2690 FIXED US205 MOBILE except aeronautical mobile Earth exploration-satellite (passive) Radio astronomy Space research (passive)	
5.149 5.412	5.149 5.208B	5.149 5.208B 5.420			

2670-2690 FIXED 5.410 MOBILE except aeronautical mobile 5.384A Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2670-2690 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.208B 5.415 MOBILE except aeronautical mobile 5.384A Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2670-2690 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (Earth-to-space) 5.351A 5.419 Earth exploration-satellite (passive) Radio astronomy Space research (passive)			
5.149 5.412	5.149	5.149	US205	US385	
2690-2700 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)			2690-2700 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive)		
5.340 5.422			US246		
2700-2900 AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation			2700-2900 METEOROLOGICAL AIDS AERONAUTICAL RADIONAVIGATION 5.337 US18 Radiolocation G2	2700-2900	Aviation (87)
5.423 5.424			5.423 G15	5.423 US18	
2900-3100 RADIOLOCATION 5.424A RADIONAVIGATION 5.426			2900-3100 RADIOLOCATION 5.424A G56 MARITIME RADIONAVIGATION	2900-3100 MARITIME RADIONAVIGATION Radiolocation US44	Maritime (80) Private Land Mobile (90)
5.425 5.427			5.427 US44 US316	5.427 US316	
3100-3300 RADIOLOCATION Earth exploration-satellite (active) Space research (active)			3100-3300 RADIOLOCATION G59 Earth exploration-satellite (active) Space research (active)	3100-3300 Earth exploration-satellite (active) Space research (active) Radiolocation	Private Land Mobile (90)
5.149 5.428			US342	US342	
3300-3400 RADIOLOCATION	3300-3400 RADIOLOCATION Amateur Fixed Mobile	3300-3400 RADIOLOCATION Amateur	3300-3500 RADIOLOCATION US431B G2	3300-3450	
5.149 5.429 5.429A 5.429B 5.430	5.149 5.429C 5.429D	5.149 5.429 5.429E 5.429F		US103 US342	
3400-3600 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.430A Radiolocation	3400-3500 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.431A 5.431B Amateur Radiolocation 5.433	3400-3500 FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile 5.432 5.432B Radiolocation 5.433		3450-3600 FIXED MOBILE except aeronautical mobile	Wireless Communications (27) Citizens Broadband (96)
5.431	5.282	5.282 5.432A	US103 US342	US103 US105 US433 US431B	Page 40

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3600-4200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile	3600-3700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.434 Radiolocation 5.433	3600-3700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation  5.435	AERONAUTICAL RADIONAVIGATION (ground-based) G110  US105 US107 US245 US433 3650-3700 FIXED FIXED-SATELLITE (space-to-Earth) NG169 NG185 MOBILE except aeronautical mobile US109 US349	3600-3650 FIXED FIXED-SATELLITE (space-to-Earth) US107 US245 MOBILE except aeronautical mobile US105 US433  3650-3700 FIXED FIXED-SATELLITE (space-to-Earth) NG169 NG185 MOBILE except aeronautical mobile US109 US349	Satellite Communications (25) Citizens Broadband (96)
	3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile		3700-4200	3700-4000 FIXED MOBILE except aeronautical mobile NG182 NG457A 4000-4200 FIXED FIXED-SATELLITE (space-to-Earth) NG457A NG182	Wireless Communications (27)  Satellite Communications (25)
4200-4400 AERONAUTICAL MOBILE (R) 5.436 AERONAUTICAL RADIONAVIGATION 5.438 5.437 5.439 5.440			4200-4400 AERONAUTICAL RADIONAVIGATION  5.440 US261		Aviation (87)
4400-4500 FIXED MOBILE 5.440A			4400-4940 FIXED MOBILE	4400-4500	
4500-4800 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 MOBILE 5.440A				4500-4800 FIXED-SATELLITE (space-to-Earth) 5.441 US245	
4800-4990 FIXED MOBILE 5.440A 5.441A 5.441B 5.442 Radio astronomy  5.149 5.339 5.443			US113 US245 US342 4940-4990	4800-4940 US113 US342 4940-4990 FIXED MOBILE except aeronautical mobile 5.339 US342 US385	Public Safety Land Mobile (90Y)
4990-5000 FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY Space research (passive) 5.149			4990-5000 RADIO ASTRONOMY US74 Space research (passive)  US246		
5000-5010 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA			5000-5010 AERONAUTICAL MOBILE (R) US115		Aviation (87)

AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (Earth-to-space)	AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (Earth-to-space) US211	
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5030-5091 AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D AERONAUTICAL RADIONAVIGATION 5.444	5030-5091 AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D AERONAUTICAL RADIONAVIGATION US260 US211 US444	
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5150-5250 FIXED-SATELLITE (Earth-to-space) 5.447A MOBILE except aeronautical mobile 5.446A 5.446B AERONAUTICAL RADIONAVIGATION 5.446 5.446C 5.447 5.447B 5.447C	5150-5250 AERONAUTICAL RADIONAVIGATION US260 US211 US307 US344	5150-5250 FIXED-SATELLITE (Earth-to-space) 5.447A US344 AERONAUTICAL RADIONAVIGATION US260 5.447C US211 US307
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5.447E 5.448 5.448A 5255-5350 EARTH EXPLORATION-SATELLITE (active) MOBILE except aeronautical mobile 5.446A 5.447F RADIOLOCATION SPACE RESEARCH (active)	5255-5350 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G59 SPACE RESEARCH (active) 5.448A	5255-5350 Earth exploration-satellite (active) Radiolocation Space research (active)
5.447E 5.448 5.448A 5350-5460 EARTH EXPLORATION-SATELLITE (active) 5.448B RADIOLOCATION 5.448D AERONAUTICAL RADIONAVIGATION 5.449 SPACE RESEARCH (active) 5.448C	5350-5460 EARTH EXPLORATION-SATELLITE (active) 5.448B RADIOLOCATION G56 AERONAUTICAL RADIONAVIGATION 5.449 SPACE RESEARCH (active) US390 G130	5350-5460 AERONAUTICAL RADIONAVIGATION 5.449 Earth exploration-satellite (active) 5.448B Radiolocation Space research (active) US390

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5.448B			5.448B US49 G130	5.448B US49	
5470-5570 EARTH EXPLORATION-SATELLITE (active) MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B MARITIME RADIONAVIGATION SPACE RESEARCH (active)			5470-5570 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 MARITIME RADIONAVIGATION US65 SPACE RESEARCH (active)	5470-5570 RADIOLOCATION MARITIME RADIONAVIGATION US65 Earth exploration-satellite (active) Space research (active)	RF Devices (15) Maritime (80) Private Land Mobile (90)
5.448B 5.450 5.451			5.448B US50 G131	US50	
5570-5650 MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B MARITIME RADIONAVIGATION			5570-5600 RADIOLOCATION G56 MARITIME RADIONAVIGATION US65	5570-5600 RADIOLOCATION MARITIME RADIONAVIGATION US65	
			US50 G131	US50	
			5600-5650 METEOROLOGICAL AIDS RADIOLOCATION G56 MARITIME RADIONAVIGATION US65	5600-5650 METEOROLOGICAL AIDS RADIOLOCATION MARITIME RADIONAVIGATION US65	
5.450 5.451 5.452			5.452 US50 G131	5.452 US50	
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5.282 5.451 5.453 5.454 5.455					
5725-5830 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur	5725-5830 RADIOLOCATION Amateur				
5.150 5.451 5.453 5.455	5.150 5.453 5.455			5.150 5.282	
5830-5850 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Amateur-satellite (space-to-Earth)	5830-5850 RADIOLOCATION Amateur Amateur-satellite (space-to-Earth)			5830-5850 Amateur Amateur-satellite (space-to-Earth)	
5.150 5.451 5.453 5.455	5.150 5.453 5.455			5.150	



5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation		5850-5925 FIXED-SATELLITE (Earth-to-space) US245 MOBILE NG160 Amateur	RF Devices (15) ISM Equipment (18) Private Land Mobile (90) Personal Radio (95) Amateur Radio (97)
5.150	5.150	5.150	5.150 US245	5.150	
5925-6700 FIXED 5.457 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C			5925-6425	5925-6425 FIXED FIXED-SATELLITE (Earth-to-space) NG457A	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
			6425-6525	6425-6525 FIXED-SATELLITE (Earth-to-space) MOBILE	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
			5.440 5.458	5.440 5.458	
			6525-6700	6525-6700 FIXED FIXED-SATELLITE (Earth-to-space)	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
5.149 5.440 5.458			5.458 US342	5.458 US342	
6700-7075 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE			6700-7125	6700-6875 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441  5.458 5.458A 5.458B	
				6875-7025 FIXED NG118 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE NG171  5.458 5.458A 5.458B	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
5.458 5.458A 5.458B				7025-7075 FIXED NG118 FIXED-SATELLITE (Earth-to-space) NG172 MOBILE NG171  5.458 5.458A 5.458B	RF Devices (15) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
7075-7145 FIXED MOBILE				7075-7125 FIXED NG118 MOBILE NG171	
			5.458	5.458	
			7125-7145 FIXED	7125-7145	RF Devices (15)
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5.458 5.459			5.458 G116		
7190-7235 EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A 5.460B FIXED MOBILE SPACE RESEARCH (Earth-to-space) 5.460			7190-7235 EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A 5.460B FIXED SPACE RESEARCH (Earth-to-space) 5.460		
5.458 5.459			5.458 G134	5.458 US262	
7235-7250 EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A FIXED MOBILE			7235-7250 EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A FIXED	7235-7250	
5.458			5.458	5.458	
7250-7300 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE			7250-7300 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Fixed	7250-8025	
5.461			G117		
7300-7375 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			7300-7375 FIXED FIXED-SATELLITE (space-to-Earth) Mobile-satellite (space-to-Earth)		
5.461			G117		
7375-7450 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB			7375-7450 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB Mobile-satellite except maritime mobile-satellite (space-to-Earth)		
			G117		
7450-7550 FIXED FIXED-SATELLITE (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB			7450-7550 FIXED FIXED-SATELLITE (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB Mobile-satellite except maritime mobile-satellite (space-to-Earth)		
5.461A			G104 G117		

7550-7750 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB	7550-7750 FIXED FIXED-SATELLITE (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) 5.461AA 5.461AB Mobile-satellite except maritime mobile-satellite (space-to-Earth) G117		
7750-7900 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) 5.461B MOBILE except aeronautical mobile	7750-7900 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) 5.461B		
7900-8025 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.461	7900-8025 FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) Fixed G117		
8025-8175 EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.463  5.462A	8025-8175 EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) Mobile-satellite (Earth-to-space)(no airborne transmissions)  US258 G117	8025-8400	
8175-8215 EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) METEOROLOGICAL-SATELLITE (Earth-to-space) MOBILE 5.463  5.462A	8175-8215 EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) METEOROLOGICAL-SATELLITE (Earth-to-space) Mobile-satellite (Earth-to-space)(no airborne transmissions)  US258 G104 G117		
8215-8400 EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.463  5.462A	8215-8400 EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) Mobile-satellite (Earth-to-space)(no airborne transmissions)  US258 G117		
8400-8500 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth) 5.465 5.466	8400-8450 FIXED SPACE RESEARCH (deep space)(space-to-Earth)  8450-8500 FIXED SPACE RESEARCH (space-to-Earth)	8400-8450 Space research (deep space) (space-to-Earth)  8450-8500 SPACE RESEARCH (space-to-Earth)	
8500-8550 RADIOLOCATION 5.468 5.469	8500-8550 RADIOLOCATION G59	8500-8550 Radiolocation	Private Land Mobile (90)
8550-8650 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) 5.468 5.469 5.469A	8550-8650 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G59 SPACE RESEARCH (active)	8550-8650 Earth exploration-satellite (active) Radiolocation Space research (active)	

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8.85-9 RADIOLOCATION MARITIME RADIONAVIGATION 5.472 5.473					
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9.2-9.3 EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474C RADIOLOCATION MARITIME RADIONAVIGATION 5.472			9-9.2 AERONAUTICAL RADIONAVIGATION 5.337 RADIOLOCATION G2	9-9.2 AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation	Maritime (80) Private Land Mobile (90)
5.473 5.474 5.474D			5.473A G19		
9.3-9.5 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION 5.475 SPACE RESEARCH (active)			9.2-9.3 MARITIME RADIONAVIGATION 5.472 Radiolocation US110 G59	9.2-9.3 MARITIME RADIONAVIGATION 5.472 Radiolocation US110	Maritime (80) Aviation (87) Private Land Mobile (90)
5.427 5.474 5.475A 5.475B 5.476A			5.474	5.474	
9.5-9.8 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION SPACE RESEARCH (active)			9.3-9.5 EARTH EXPLORATION- SATELLITE (active) RADIOLOCATION G56 RADIONAVIGATION US475 SPACE RESEARCH (active) Meteorological aids	9.3-9.5 RADIONAVIGATION US475 Meteorological aids Earth exploration-satellite (active) Radiolocation Space research (active)	Private Land Mobile (90)
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5.477 5.478 5.478A 5.478B			9.8-9.9 RADIOLOCATION Earth exploration-satellite (active) Space research (active)		
9.9-10 EARTH EXPLORATION-SATELLITE (active) 5.474A 5.474B 5.474C RADIOLOCATION Fixed			9.9-10 RADIOLOCATION	9.9-10 Radiolocation	
5.474D 5.477 5.478 5.479			5.479	5.479	

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10.4-10.45 FIXED MOBILE RADIOLOCATION Amateur	10.4-10.45 RADIOLOCATION Amateur 5.480	10.4-10.45 FIXED MOBILE RADIOLOCATION Amateur		10.45-10.5 Amateur Amateur-satellite Radiolocation US108	
10.45-10.5 RADIOLOCATION Amateur Amateur-satellite 5.481				US128 NG50	
10.5-10.55 FIXED MOBILE Radiolocation	10.5-10.55 FIXED MOBILE RADIOLOCATION		10.5-10.55 RADIOLOCATION US59		Private Land Mobile (90)
10.55-10.6 FIXED MOBILE except aeronautical mobile Radiolocation			10.55-10.6	10.55-10.6 FIXED	Fixed Microwave (101)
10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) Radiolocation 5.149 5.482 5.482A			10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) US130 US131 US482	10.6-10.68 EARTH EXPLORATION-SATELLITE (passive) FIXED US482 SPACE RESEARCH (passive) US130 US131	
10.68-10.7 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.483			10.68-10.7 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) US131 US246		
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## Footnotes

### International Footnotes

**5.53** Administrations authorizing the use of frequencies below 8.3 kHz shall ensure that no harmful interference is caused to services to which the bands above 8.3 kHz are allocated. (WRC-12)

**5.54** Administrations conducting scientific research using frequencies below 8.3 kHz are urged to advise other administrations that may be concerned in order that such research may be afforded all practicable protection from harmful interference. (WRC-12)

**5.54A** Use of the 8.3-11.3 kHz frequency band by stations in the meteorological aids service is limited to passive use only. In the band 9-11.3 kHz, meteorological aids stations shall not claim protection from stations of the radionavigation service submitted for notification to the Bureau prior to 1 January 2013. For sharing between stations of the meteorological aids service and stations in the radionavigation service submitted for notification after this date, the most recent version of Recommendation ITU-R RS.1881 should be applied. (WRC-12)

**5.54B** *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Egypt, the United Arab Emirates, the Russian Federation, Iran (Islamic Republic of), Iraq, Kuwait, Lebanon, Morocco, Qatar, the Syrian Arab Republic, Sudan and Tunisia, the frequency band 8.3-9 kHz is also allocated to the radionavigation, fixed and mobile services on a primary basis. (WRC-15)

**5.54C** *Additional allocation:* in China, the frequency band 8.3-9 kHz is also allocated to the maritime radionavigation and maritime mobile services on a primary basis. (WRC-12)

**5.55** *Additional allocation:* in Armenia, the Russian Federation, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan, the frequency band 14-17 kHz is also allocated to the radionavigation service on a primary basis. (WRC-15)

**5.56** The stations of services to which the bands 14-19.95 kHz and 20.05-70 kHz and in Region 1 also the bands 72-84 kHz and 86-90 kHz are allocated may transmit standard frequency and time signals. Such stations shall be afforded protection from harmful interference. In Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan, the frequencies 25 kHz and 50 kHz will be used for this purpose under the same conditions. (WRC-12)

**5.57** The use of the bands 14-19.95 kHz, 20.05-70 kHz and 70-90 kHz (72-84 kHz and 86-90 kHz in Region 1) by the maritime mobile service is limited to coast radiotelegraph stations (A1A and F1B only). Exceptionally, the use of class J2B or J7B emissions is authorized subject to the necessary bandwidth not exceeding that normally used for class A1A or F1B emissions in the band concerned.

**5.58** *Additional allocation:* in Armenia, Azerbaijan, the Russian Federation, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan, the band 67-70 kHz is also allocated to the radionavigation service on a primary basis.

**5.59** *Different category of service:* in Bangladesh and Pakistan, the allocation of the bands 70-72 kHz and 84-86 kHz to the fixed and maritime mobile services is on a primary basis (see No. 5.33).

**5.60** In the bands 70-90 kHz (70-86 kHz in Region 1) and 110-130 kHz (112-130 kHz in Region 1), pulsed radionavigation systems may be used on condition that they do not cause harmful interference to other services to which these bands are allocated.

**5.61** In Region 2, the establishment and operation of stations in the maritime radionavigation service in the bands 70-90 kHz and 110-130 kHz shall be subject to agreement obtained under No. 9.21 with administrations whose services, operating in accordance with the Table, may be affected. However, stations

of the fixed, maritime mobile and radiolocation services shall not cause harmful interference to stations in the maritime radionavigation service established under such agreements.

**5.62** Administrations which operate stations in the radionavigation service in the band 90-110 kHz are urged to coordinate technical and operating characteristics in such a way as to avoid harmful interference to the services provided by these stations.

**5.64** Only classes A1A or F1B, A2C, A3C, F1C or F3C emissions are authorized for stations of the fixed service in the bands allocated to this service between 90 kHz and 160 kHz (148.5 kHz in Region 1) and for stations of the maritime mobile service in the bands allocated to this service between 110 kHz and 160 kHz (148.5 kHz in Region 1). Exceptionally, class J2B or J7B emissions are also authorized in the bands between 110 kHz and 160 kHz (148.5 kHz in Region 1) for stations of the maritime mobile service.

**5.65** *Different category of service:* in Bangladesh, the allocation of the bands 112-117.6 kHz and 126-129 kHz to the fixed and maritime mobile services is on a primary basis (see No. 5.33).

**5.66** *Different category of service:* in Germany, the allocation of the band 115-117.6 kHz to the fixed and maritime mobile services is on a primary basis (see No. 5.33) and to the radionavigation service on a secondary basis (see No. 5.32).

**5.67** *Additional allocation:* in Mongolia, Kyrgyzstan and Turkmenistan, the band 130-148.5 kHz is also allocated to the radionavigation service on a secondary basis. Within and between these countries this service shall have an equal right to operate. (WRC-07)

**5.67A** Stations in the amateur service using frequencies in the band 135.7-137.8 kHz shall not exceed a maximum radiated power of 1 W (e.i.r.p.) and shall not cause harmful interference to stations of the radionavigation service operating in countries listed in No. 5.67. (WRC-07)

**5.67B** The use of the band 135.7-137.8 kHz in Algeria, Egypt, Iran (Islamic Republic of), Iraq, Lebanon, Syrian Arab Republic, Sudan, South Sudan and Tunisia is limited to the fixed and maritime mobile services. The amateur service shall not be used in the above-mentioned countries in the band 135.7-137.8 kHz, and this should be taken into account by the countries authorizing such use. (WRC-12)

**5.68** *Alternative allocation:* in Congo (Rep. of the), the Dem. Rep. of the Congo and South Africa, the frequency band 160-200 kHz is allocated to the fixed service on a primary basis. (WRC-15)

**5.69** *Additional allocation:* in Somalia, the band 200-255 kHz is also allocated to the aeronautical radionavigation service on a primary basis.

**5.70** *Alternative allocation:* in Angola, Botswana, Burundi, the Central African Rep., Congo (Rep. of the), Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Nigeria, Oman, the Dem. Rep. of the Congo, South Africa, Swaziland, Tanzania, Chad, Zambia and Zimbabwe, the band 200-283.5 kHz is allocated to the aeronautical radionavigation service on a primary basis. (WRC-12)

**5.71** *Alternative allocation:* in Tunisia, the band 255-283.5 kHz is allocated to the broadcasting service on a primary basis.

**5.73** The band 285-325 kHz (283.5-325 kHz in Region 1) in the maritime radionavigation service may be used to transmit supplementary navigational information using narrow-band techniques, on condition that no harmful interference is caused to radiobeacon stations operating in the radionavigation service.

**5.74** *Additional allocation:* in Region 1, the frequency band 285.3-285.7 kHz is also allocated to the maritime radionavigation service (other than radiobeacons) on a primary basis.

**5.75** *Different category of service:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Moldova, Kyrgyzstan, Tajikistan, Turkmenistan, Ukraine and the Black Sea areas of Romania, the allocation of the band 315-325 kHz to the maritime radionavigation service is on a primary basis under the condition that in the Baltic Sea area, the assignment of frequencies in this band to new stations in the

maritime or aeronautical radionavigation services shall be subject to prior consultation between the administrations concerned. (WRC-07)

**5.76** The frequency 410 kHz is designated for radio direction-finding in the maritime radionavigation service. The other radionavigation services to which the band 405-415 kHz is allocated shall not cause harmful interference to radio direction-finding in the band 406.5-413.5 kHz.

**5.77** *Different category of service:* in Australia, China, the French overseas communities of Region 3, Korea (Rep. of), India, Iran (Islamic Republic of), Japan, Pakistan, Papua New Guinea and Sri Lanka, the allocation of the frequency band 415-495 kHz to the aeronautical radionavigation service is on a primary basis. In Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Latvia, Uzbekistan and Kyrgyzstan, the allocation of the frequency band 435-495 kHz to the aeronautical radionavigation service is on a primary basis. Administrations in all the aforementioned countries shall take all practical steps necessary to ensure that aeronautical radionavigation stations in the frequency band 435-495 kHz do not cause interference to reception by coast stations of transmissions from ship stations on frequencies designated for ship stations on a worldwide basis. (WRC-12)

**5.78** *Different category of service:* in Cuba, the United States of America and Mexico, the allocation of the band 415-435 kHz to the aeronautical radionavigation service is on a primary basis.

**5.79** The use of the bands 415-495 kHz and 505-526.5 kHz (505-510 kHz in Region 2) by the maritime mobile service is limited to radiotelegraphy.

**5.79A** When establishing coast stations in the NAVTEX service on the frequencies 490 kHz, 518 kHz and 4209.5 kHz, administrations are strongly recommended to coordinate the operating characteristics in accordance with the procedures of the International Maritime Organization (IMO) (see Resolution 339 (Rev.WRC-07)). (WRC-07)

**5.80** In Region 2, the use of the band 435-495 kHz by the aeronautical radionavigation service is limited to non-directional beacons not employing voice transmission.

**5.80A** The maximum equivalent isotropically radiated power (e.i.r.p.) of stations in the amateur service using frequencies in the band 472-479 kHz shall not exceed 1 W. Administrations may increase this limit of e.i.r.p. to 5 W in portions of their territory which are at a distance of over 800 km from the borders of Algeria, Saudi Arabia, Azerbaijan, Bahrain, Belarus, China, Comoros, Djibouti, Egypt, United Arab Emirates, the Russian Federation, Iran (Islamic Republic of), Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Morocco, Mauritania, Oman, Uzbekistan, Qatar, Syrian Arab Republic, Kyrgyzstan, Somalia, Sudan, Tunisia, Ukraine and Yemen. In this frequency band, stations in the amateur service shall not cause harmful interference to, or claim protection from, stations of the aeronautical radionavigation service. (WRC-12)

**5.80B** The use of the frequency band 472-479 kHz in Algeria, Saudi Arabia, Azerbaijan, Bahrain, Belarus, China, Comoros, Djibouti, Egypt, United Arab Emirates, the Russian Federation, Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Mauritania, Oman, Uzbekistan, Qatar, Syrian Arab Republic, Kyrgyzstan, Somalia, Sudan, Tunisia and Yemen is limited to the maritime mobile and aeronautical radionavigation services. The amateur service shall not be used in the above-mentioned countries in this frequency band, and this should be taken into account by the countries authorizing such use. (WRC-12)

**5.82** In the maritime mobile service, the frequency 490 kHz is to be used exclusively for the transmission by coast stations of navigational and meteorological warnings and urgent information to ships, by means of narrow-band direct-printing telegraphy. The conditions for use of the frequency 490 kHz are prescribed in Articles 31 and 52. In using the frequency band 415-495 kHz for the aeronautical radionavigation service, administrations are requested to ensure that no harmful interference is caused to the frequency 490 kHz. In using the frequency band 472-479 kHz for the amateur service, administrations shall ensure that no harmful interference is caused to the frequency 490 kHz. (WRC-12)

**5.84** The conditions for the use of the frequency 518 kHz by the maritime mobile service are prescribed in Articles 31 and 52. (WRC-07)

**5.86** In Region 2, in the band 525-535 kHz the carrier power of broadcasting stations shall not exceed 1 kW during the day and 250 W at night.

**5.87** *Additional allocation:* in Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Niger and Swaziland, the band 526.5-535 kHz is also allocated to the mobile service on a secondary basis. (WRC-12)

**5.87A** *Additional allocation:* in Uzbekistan, the band 526.5-1606.5 kHz is also allocated to the radionavigation service on a primary basis. Such use is subject to agreement obtained under No. 9.21 with administrations concerned and limited to ground-based radiobeacons in operation on 27 October 1997 until the end of their lifetime.

**5.88** *Additional allocation:* in China, the band 526.5-535 kHz is also allocated to the aeronautical radionavigation service on a secondary basis.

**5.89** In Region 2, the use of the band 1605-1705 kHz by stations of the broadcasting service is subject to the Plan established by the Regional Administrative Radio Conference (Rio de Janeiro, 1988).

The examination of frequency assignments to stations of the fixed and mobile services in the band 1625-1705 kHz shall take account of the allotments appearing in the Plan established by the Regional Administrative Radio Conference (Rio de Janeiro, 1988).

**5.90** In the band 1605-1705 kHz, in cases where a broadcasting station of Region 2 is concerned, the service area of the maritime mobile stations in Region 1 shall be limited to that provided by ground-wave propagation.

**5.91** *Additional allocation:* in the Philippines and Sri Lanka, the band 1606.5-1705 kHz is also allocated to the broadcasting service on a secondary basis.

**5.92** Some countries of Region 1 use radiodetermination systems in the bands 1606.5-1625 kHz, 1635-1800 kHz, 1850-2160 kHz, 2194-2300 kHz, 2502-2850 kHz and 3500-3800 kHz, subject to agreement obtained under No. 9.21. The radiated mean power of these stations shall not exceed 50 W.

**5.93** *Additional allocation:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Mongolia, Nigeria, Uzbekistan, Poland, Kyrgyzstan, Slovakia, Tajikistan, Chad, Turkmenistan and Ukraine, the frequency bands 1625-1635 kHz, 1800-1810 kHz and 2160-2170 kHz are also allocated to the fixed and land mobile services on a primary basis, subject to agreement obtained under No. 9.21. (WRC-15)

**5.96** In Germany, Armenia, Austria, Azerbaijan, Belarus, Croatia, Denmark, Estonia, the Russian Federation, Finland, Georgia, Hungary, Ireland, Iceland, Israel, Kazakhstan, Latvia, Liechtenstein, Lithuania, Malta, Moldova, Norway, Uzbekistan, Poland, Kyrgyzstan, Slovakia, the Czech Rep., the United Kingdom, Sweden, Switzerland, Tajikistan, Turkmenistan and Ukraine, administrations may allocate up to 200 kHz to their amateur service in the frequency bands 1715-1800 kHz and 1850-2000 kHz. However, when allocating the frequency bands within this range to their amateur service, administrations shall, after prior consultation with administrations of neighbouring countries, take such steps as may be necessary to prevent harmful interference from their amateur service to the fixed and mobile services of other countries. The mean power of any amateur station shall not exceed 10 W. (WRC-15)

**5.97** In Region 3, the Loran system operates either on 1850 kHz or 1950 kHz, the bands occupied being 1825-1875 kHz and 1925-1975 kHz respectively. Other services to which the band 1800-2000 kHz is allocated may use any frequency therein on condition that no harmful interference is caused to the Loran system operating on 1850 kHz or 1950 kHz.

**5.98** *Alternative allocation:* in Armenia, Azerbaijan, Belarus, Belgium, Cameroon, Congo (Rep. of the),

Denmark, Egypt, Eritrea, Spain, Ethiopia, the Russian Federation, Georgia, Greece, Italy, Kazakhstan, Lebanon, Lithuania, the Syrian Arab Republic, Kyrgyzstan, Somalia, Tajikistan, Tunisia, Turkmenistan and Turkey, the frequency band 1810-1830 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-15)

**5.99** *Additional allocation:* in Saudi Arabia, Austria, Iraq, Libya, Uzbekistan, Slovakia, Romania, Slovenia, Chad, and Togo, the band 1810-1830 kHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.100** In Region 1, the authorization to use the band 1810-1830 kHz by the amateur service in countries situated totally or partially north of 40° N shall be given only after consultation with the countries mentioned in Nos. 5.98 and 5.99 to define the necessary steps to be taken to prevent harmful interference between amateur stations and stations of other services operating in accordance with Nos. 5.98 and 5.99.

**5.102** *Alternative allocation:* in Bolivia, Chile, Paraguay and Peru, the frequency band 1850-2000 kHz is allocated to the fixed, mobile except aeronautical mobile, radiolocation and radionavigation services on a primary basis. (WRC-15)

**5.103** In Region 1, in making assignments to stations in the fixed and mobile services in the bands 1850-2045 kHz, 2194-2498 kHz, 2502-2625 kHz and 2650-2850 kHz, administrations should bear in mind the special requirements of the maritime mobile service.

**5.104** In Region 1, the use of the band 2025-2045 kHz by the meteorological aids service is limited to oceanographic buoy stations.

**5.105** In Region 2, except in Greenland, coast stations and ship stations using radiotelephony in the band 2065-2107 kHz shall be limited to class J3E emissions and to a peak envelope power not exceeding 1 kW. Preferably, the following carrier frequencies should be used: 2065.0 kHz, 2079.0 kHz, 2082.5 kHz, 2086.0 kHz, 2093.0 kHz, 2096.5 kHz, 2100.0 kHz and 2103.5 kHz. In Argentina and Uruguay, the carrier frequencies 2068.5 kHz and 2075.5 kHz are also used for this purpose, while the frequencies within the band 2072-2075.5 kHz are used as provided in No. 52.165.

**5.106** In Regions 2 and 3, provided no harmful interference is caused to the maritime mobile service, the frequencies between 2065 kHz and 2107 kHz may be used by stations of the fixed service communicating only within national borders and whose mean power does not exceed 50 W. In notifying the frequencies, the attention of the Bureau should be drawn to these provisions.

**5.107** *Additional allocation:* in Saudi Arabia, Eritrea, Ethiopia, Iraq, Libya, Somalia and Swaziland, the band 2160-2170 kHz is also allocated to the fixed and mobile, except aeronautical mobile (R), services on a primary basis. The mean power of stations in these services shall not exceed 50 W. (WRC-12)

**5.108** The carrier frequency 2182 kHz is an international distress and calling frequency for radiotelephony. The conditions for the use of the band 2173.5-2190.5 kHz are prescribed in Articles 31 and 52. (WRC-07)

**5.109** The frequencies 2187.5 kHz, 4207.5 kHz, 6312 kHz, 8414.5 kHz, 12 577 kHz and 16 804.5 kHz are international distress frequencies for digital selective calling. The conditions for the use of these frequencies are prescribed in Article 31.

**5.110** The frequencies 2174.5 kHz, 4177.5 kHz, 6268 kHz, 8376.5 kHz, 12 520 kHz and 16 695 kHz are international distress frequencies for narrow-band direct-printing telegraphy. The conditions for the use of these frequencies are prescribed in Article 31.

**5.111** The carrier frequencies 2182 kHz, 3023 kHz, 5680 kHz, 8364 kHz and the frequencies 121.5 MHz, 156.525 MHz, 156.8 MHz and 243 MHz may also be used, in accordance with the procedures in force for terrestrial radiocommunication services, for search and rescue operations concerning manned space vehicles. The conditions for the use of the frequencies are prescribed in Article 31.

The same applies to the frequencies 10 003 kHz, 14 993 kHz and 19 993 kHz, but in each of these cases emissions must be confined in a band of  $\pm 3$  kHz about the frequency. (WRC-07)

**5.112** *Alternative allocation:* in Denmark and Sri Lanka, the band 2194-2300 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.113** For the conditions for the use of the bands 2300-2495 kHz (2498 kHz in Region 1), 3200-3400 kHz, 4750-4995 kHz and 5005-5060 kHz by the broadcasting service, see Nos. 5.16 to 5.20, 5.21 and 23.3 to 23.10.

**5.114** *Alternative allocation:* in Denmark and Iraq, the band 2502-2625 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.115** The carrier (reference) frequencies 3023 kHz and 5680 kHz may also be used, in accordance with Article 31, by stations of the maritime mobile service engaged in coordinated search and rescue operations. (WRC-07)

**5.116** Administrations are urged to authorize the use of the band 3155-3195 kHz to provide a common worldwide channel for low power wireless hearing aids. Additional channels for these devices may be assigned by administrations in the bands between 3155 kHz and 3400 kHz to suit local needs.

It should be noted that frequencies in the range 3000 kHz to 4000 kHz are suitable for hearing aid devices which are designed to operate over short distances within the induction field.

**5.117** *Alternative allocation:* in Côte d'Ivoire, Denmark, Egypt, Liberia, Sri Lanka and Togo, the band 3155-3200 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.118** *Additional allocation:* in the United States, Mexico, Peru and Uruguay, the band 3230-3400 kHz is also allocated to the radiolocation service on a secondary basis.

**5.119** *Additional allocation:* in Peru, the frequency band 3500-3750 kHz is also allocated to the fixed and mobile services on a primary basis. (WRC-15)

**5.122** *Alternative allocation:* in Bolivia, Chile, Ecuador, Paraguay and Peru, the frequency band 3750-4000 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-15)

**5.123** *Additional allocation:* in Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe, the band 3900-3950 kHz is also allocated to the broadcasting service on a primary basis, subject to agreement obtained under No. 9.21.

**5.125** *Additional allocation:* in Greenland, the band 3950-4000 kHz is also allocated to the broadcasting service on a primary basis. The power of the broadcasting stations operating in this band shall not exceed that necessary for a national service and shall in no case exceed 5 kW.

**5.126** In Region 3, the stations of those services to which the band 3995-4005 kHz is allocated may transmit standard frequency and time signals.

**5.127** The use of the band 4000-4063 kHz by the maritime mobile service is limited to ship stations using radiotelephony (see No. 52.220 and Appendix 17).

**5.128** Frequencies in the bands 4063-4123 kHz and 4130-4438 kHz may be used exceptionally by stations in the fixed service, communicating only within the boundary of the country in which they are located, with a mean power not exceeding 50 W, on condition that harmful interference is not caused to the maritime mobile service. In addition, in Afghanistan, Argentina, Armenia, Azerbaijan, Belarus, Botswana, Burkina Faso, the Central African Rep., China, the Russian Federation, Georgia, India, Kazakhstan, Mali, Niger, Pakistan, Kyrgyzstan, Tajikistan, Chad, Turkmenistan and Ukraine, in the bands 4063-4123 kHz, 4130-4133 kHz and 4408-4438 kHz, stations in the fixed service, with a mean power not exceeding 1 kW,

can be operated on condition that they are situated at least 600 km from the coast and that harmful interference is not caused to the maritime mobile service. (WRC-12)

**5.130** The conditions for the use of the carrier frequencies 4125 kHz and 6215 kHz are prescribed in Articles 31 and 52. (WRC-07)

**5.131** The frequency 4209.5 kHz is used exclusively for the transmission by coast stations of meteorological and navigational warnings and urgent information to ships by means of narrow-band direct-printing techniques.

**5.132** The frequencies 4210 kHz, 6314 kHz, 8416.5 kHz, 12 579 kHz, 16 806.5 kHz, 19 680.5 kHz, 22 376 kHz and 26 100.5 kHz are the international frequencies for the transmission of maritime safety information (MSI) (see Appendix 17).

**5.132A** Stations in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the fixed or mobile services. Applications of the radiolocation service are limited to oceanographic radars operating in accordance with Resolution 612 (Rev.WRC-12). (WRC-12)

**5.132B** *Alternative allocation:* in Armenia, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 4438-4488 kHz is allocated to the fixed and mobile, except aeronautical mobile (R), services on a primary basis. (WRC-15)

**5.133** *Different category of service:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Latvia, Lithuania, Niger, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the allocation of the band 5130-5250 kHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. 5.33). (WRC-12)

**5.133A** *Alternative allocation:* in Armenia, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency bands 5250-5275 kHz and 26 200-26 350 kHz are allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-15)

**5.133B** Stations in the amateur service using the frequency band 5351.5-5366.5 kHz shall not exceed a maximum radiated power of 15 W (e.i.r.p.). However, in Region 2 in Mexico, stations in the amateur service using the frequency band 5351.5-5366.5 kHz shall not exceed a maximum radiated power of 20 W (e.i.r.p.). In the following Region 2 countries: Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Dominica, El Salvador, Ecuador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela, as well as the overseas territories of the Netherlands in Region 2, stations in the amateur service using the frequency band 5351.5-5366.5 kHz shall not exceed a maximum radiated power of 25 W (e.i.r.p.). (WRC-15)

**5.134** The use of the bands 5900-5950 kHz, 7300-7350 kHz, 9400-9500 kHz, 11 600-11 650 kHz, 12 050-12 100 kHz, 13 570-13 600 kHz, 13 800-13 870 kHz, 15 600-15 800 kHz, 17 480-17 550 kHz and 18 900-19 020 kHz by the broadcasting service is subject to the application of the procedure of Article 12. Administrations are encouraged to use these bands to facilitate the introduction of digitally modulated emissions in accordance with the provisions of Resolution 517 (Rev.WRC-15). (FCC)

**5.136** *Additional allocation:* frequencies in the band 5900-5950 kHz may be used by stations in the following services, communicating only within the boundary of the country in which they are located: fixed service (in all three Regions), land mobile service (in Region 1), mobile except aeronautical mobile (R) service (in Regions 2 and 3), on condition that harmful interference is not caused to the broadcasting service. When using frequencies for these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-07)



**5.137** On condition that harmful interference is not caused to the maritime mobile service, the bands 6200-6213.5 kHz and 6220.5-6525 kHz may be used exceptionally by stations in the fixed service, communicating only within the boundary of the country in which they are located, with a mean power not exceeding 50 W. At the time of notification of these frequencies, the attention of the Bureau will be drawn to the above conditions.

**5.138** The following bands:

6765-6795 kHz (centre frequency 6780 kHz),

433.05-434.79 MHz (centre frequency 433.92 MHz) in Region 1 except in the countries mentioned in No. 5.280,

61-61.5 GHz (centre frequency 61.25 GHz),

122-123 GHz (centre frequency 122.5 GHz), and

244-246 GHz (centre frequency 245 GHz)

are designated for industrial, scientific and medical (ISM) applications. The use of these frequency bands for ISM applications shall be subject to special authorization by the administration concerned, in agreement with other administrations whose radiocommunication services might be affected. In applying this provision, administrations shall have due regard to the latest relevant ITU-R Recommendations.

**5.140** *Additional allocation:* in Angola, Iraq, Somalia and Togo, the frequency band 7000-7050 kHz is also allocated to the fixed service on a primary basis. (WRC-15)

**5.141** *Alternative allocation:* in Egypt, Eritrea, Ethiopia, Guinea, Libya, Madagascar and Niger, the band 7000-7050 kHz is allocated to the fixed service on a primary basis. (WRC-12)

**5.141A** *Additional allocation:* in Uzbekistan and Kyrgyzstan, the bands 7000-7100 kHz and 7100-7200 kHz are also allocated to the fixed and land mobile services on a secondary basis.

**5.141B** *Additional allocation:* in Algeria, Saudi Arabia, Australia, Bahrain, Botswana, Brunei Darussalam, China, Comoros, Korea (Rep. of), Diego Garcia, Djibouti, Egypt, United Arab Emirates, Eritrea, Guinea, Indonesia, Iran (Islamic Republic of), Japan, Jordan, Kuwait, Libya, Mali, Morocco, Mauritania, Niger, New Zealand, Oman, Papua New Guinea, Qatar, the Syrian Arab Republic, Singapore, Sudan, South Sudan, Tunisia, Viet Nam and Yemen, the frequency band 7100-7200 kHz is also allocated to the fixed and the mobile, except aeronautical mobile (R), services on a primary basis. (WRC-15)

**5.142** The use of the band 7200-7300 kHz in Region 2 by the amateur service shall not impose constraints on the broadcasting service intended for use within Region 1 and Region 3. (WRC-12)

**5.143** *Additional allocation:* frequencies in the band 7300-7350 kHz may be used by stations in the fixed service and in the land mobile service, communicating only within the boundary of the country in which they are located, on condition that harmful interference is not caused to the broadcasting service. When using frequencies for these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-07)

**5.143A** In Region 3, frequencies in the band 7350-7450 kHz may be used by stations in the fixed service on a primary basis and land mobile service on a secondary basis, communicating only within the boundary of the country in which they are located, on condition that harmful interference is not caused to the broadcasting service. When using frequencies for these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-12)

**5.143B** In Region 1, frequencies in the band 7350-7450 kHz may be used by stations in the fixed and land mobile services communicating only within the boundary of the country in which they are located on condition that harmful interference is not caused to the broadcasting service. The total radiated power of each station shall not exceed 24 dBW. (WRC-12)

**5.143C** *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Comoros, Djibouti, Egypt, United Arab Emirates, Iran (Islamic Republic of), Jordan, Kuwait, Libya, Morocco, Mauritania, Niger, Oman, Qatar, the Syrian Arab Republic, Sudan, South Sudan, Tunisia and Yemen, the bands 7350-7400 kHz and 7400-7450 kHz are also allocated to the fixed service on a primary basis. (WRC-12)

**5.143D** In Region 2, frequencies in the band 7350-7400 kHz may be used by stations in the fixed service and in the land mobile service, communicating only within the boundary of the country in which they are located, on condition that harmful interference is not caused to the broadcasting service. When using frequencies for these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-12)

**5.144** In Region 3, the stations of those services to which the band 7995-8005 kHz is allocated may transmit standard frequency and time signals.

**5.145** The conditions for the use of the carrier frequencies 8291 kHz, 12 290 kHz and 16 420 kHz are prescribed in Articles 31 and 52. (WRC-07)

**5.145A** Stations in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the fixed service. Applications of the radiolocation service are limited to oceanographic radars operating in accordance with Resolution 612 (Rev.WRC-12). (WRC-12)

**5.145B** *Alternative allocation:* in Armenia, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency bands 9305-9355 kHz and 16 100-16 200 kHz are allocated to the fixed service on a primary basis. (WRC-15)

**5.146** *Additional allocation:* frequencies in the bands 9400-9500 kHz, 11 600-11 650 kHz, 12 050-12 100 kHz, 15 600-15 800 kHz, 17 480-17 550 kHz and 18 900-19 020 kHz may be used by stations in the fixed service, communicating only within the boundary of the country in which they are located, on condition that harmful interference is not caused to the broadcasting service. When using frequencies in the fixed service, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-07)

**5.147** On condition that harmful interference is not caused to the broadcasting service, frequencies in the bands 9775-9900 kHz, 11 650-11 700 kHz and 11 975-12 050 kHz may be used by stations in the fixed service communicating only within the boundary of the country in which they are located, each station using a total radiated power not exceeding 24 dBW.

**5.149** In making assignments to stations of other services to which the bands:

13 360-13 410 kHz,	23.07-23.12 GHz,
25 550-25 670 kHz,	31.2-31.3 GHz,
37.5-38.25 MHz,	31.5-31.8 GHz in Regions 1 and 3,
73-74.6 MHz in Regions 1 and 3,	36.43-36.5 GHz,
150.05-153 MHz in Region 1,	42.5-43.5 GHz,
322-328.6 MHz,	48.94-49.04 GHz,
406.1-410 MHz,	76-86 GHz,
608-614 MHz in Regions 1 and 3,	92-94 GHz,
1330-1400 MHz,	94.1-100 GHz,
1610.6-1613.8 MHz,	102-109.5 GHz,
1660-1670 MHz,	111.8-114.25 GHz,
1718.8-1722.2 MHz,	128.33-128.59 GHz,
2655-2690 MHz,	129.23-129.49 GHz,
3260-3267 MHz,	130-134 GHz,
3332-3339 MHz,	136-148.5 GHz,
3345.8-3352.5 MHz,	151.5-158.5 GHz,
4825-4835 MHz,	168.59-168.93 GHz,
4950-4990 MHz,	171.11-171.45 GHz,
4990-5000 MHz,	172.31-172.65 GHz,
6650-6675.2 MHz,	173.52-173.85 GHz,
10.6-10.68 GHz,	195.75-196.15 GHz,
14.47-14.5 GHz,	209-226 GHz,
22.01-22.21 GHz,	241-250 GHz,
22.21-22.5 GHz,	252-275 GHz
22.81-22.86 GHz,	

are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 4.5 and 4.6 and Article 29). (WRC-07)

**5.149A** *Alternative allocation:* in Armenia, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 13 450-13 550 kHz is allocated to the fixed service on a primary basis and to the mobile, except aeronautical mobile (R), service on a secondary basis. (WRC-15)

**5.150** The following bands:

13 553-13 567 kHz (centre frequency 13 560 kHz),  
26 957-27 283 kHz (centre frequency 27 120 kHz),  
40.66-40.70 MHz (centre frequency 40.68 MHz),  
902-928 MHz in Region 2 (centre frequency 915 MHz),  
2400-2500 MHz (centre frequency 2450 MHz),  
5725-5875 MHz (centre frequency 5800 MHz), and  
24-24.25 GHz (centre frequency 24.125 GHz)

are also designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of No. 15.13.

**5.151** *Additional allocation:* frequencies in the bands 13 570-13 600 kHz and 13 800-13 870 kHz may be used by stations in the fixed service and in the mobile except aeronautical mobile (R) service, communicating only within the boundary of the country in which they are located, on the condition that harmful interference is not caused to the broadcasting service. When using frequencies in these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-07)

**5.152 Additional allocation:** in Armenia, Azerbaijan, China, Côte d'Ivoire, the Russian Federation, Georgia, Iran (Islamic Republic of), Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 14 250-14 350 kHz is also allocated to the fixed service on a primary basis. Stations of the fixed service shall not use a radiated power exceeding 24 dBW.

**5.153** In Region 3, the stations of those services to which the band 15 995-16 005 kHz is allocated may transmit standard frequency and time signals.

**5.154 Additional allocation:** in Armenia, Azerbaijan, the Russian Federation, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 18 068-18 168 kHz is also allocated to the fixed service on a primary basis for use within their boundaries, with a peak envelope power not exceeding 1 kW.

**5.155 Additional allocation:** in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, Slovakia, Tajikistan, Turkmenistan and Ukraine, the band 21 850-21 870 kHz is also allocated to the aeronautical mobile (R) service on a primary basis. (WRC-07)

**5.155A** In Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, Slovakia, Tajikistan, Turkmenistan and Ukraine, the use of the band 21 850-21 870 kHz by the fixed service is limited to provision of services related to aircraft flight safety. (WRC-07)

**5.155B** The band 21 870-21 924 kHz is used by the fixed service for provision of services related to aircraft flight safety.

**5.156 Additional allocation:** in Nigeria, the band 22 720-23 200 kHz is also allocated to the meteorological aids service (radiosondes) on a primary basis.

**5.156A** The use of the band 23 200-23 350 kHz by the fixed service is limited to provision of services related to aircraft flight safety.

**5.157** The use of the band 23 350-24 000 kHz by the maritime mobile service is limited to inter-ship radiotelegraphy.

**5.158 Alternative allocation:** in Armenia, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 24 450-24 600 kHz is allocated to the fixed and land mobile services on a primary basis. (WRC-15)

**5.159 Alternative allocation:** in Armenia, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 39-39.5 MHz is allocated to the fixed and mobile services on a primary basis. (WRC-15)

**5.160 Additional allocation:** in Botswana, Burundi, Dem. Rep. of the Congo and Rwanda, the band 41-44 MHz is also allocated to the aeronautical radionavigation service on a primary basis. (WRC-12)

**5.161 Additional allocation:** in Iran (Islamic Republic of) and Japan, the band 41-44 MHz is also allocated to the radiolocation service on a secondary basis.

**5.161A Additional allocation:** in Korea (Rep. of) and the United States, the frequency bands 41.015-41.665 MHz and 43.35-44 MHz are also allocated to the radiolocation service on a primary basis. Stations in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the fixed or mobile services. Applications of the radiolocation service are limited to oceanographic radars operating in accordance with Resolution 612 (Rev.WRC-12). (WRC-12)

**5.161B Alternative allocation:** in Albania, Germany, Armenia, Austria, Belarus, Belgium, Bosnia and Herzegovina, Cyprus, Vatican, Croatia, Denmark, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Latvia, The Former Yugoslav Rep. of Macedonia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Norway, Uzbekistan, Netherlands, Portugal, Kyrgyzstan, Slovakia, Czech Rep., Romania, United Kingdom, San Marino, Slovenia, Sweden,

Switzerland, Turkey and Ukraine, the frequency band 42-42.5 MHz is allocated to the fixed and mobile services on a primary basis. (WRC-15)

**5.162** *Additional allocation:* in Australia, the band 44-47 MHz is also allocated to the broadcasting service on a primary basis. (WRC-12)

**5.162A** *Additional allocation:* in Germany, Austria, Belgium, Bosnia and Herzegovina, China, Vatican, Denmark, Spain, Estonia, the Russian Federation, Finland, France, Ireland, Iceland, Italy, Latvia, The Former Yugoslav Republic of Macedonia, Liechtenstein, Lithuania, Luxembourg, Monaco, Montenegro, Norway, the Netherlands, Poland, Portugal, the Czech Rep., the United Kingdom, Serbia, Slovenia, Sweden and Switzerland the band 46-68 MHz is also allocated to the radiolocation service on a secondary basis. This use is limited to the operation of wind profiler radars in accordance with Resolution 217 (WRC-97). (WRC-12)

**5.163** *Additional allocation:* in Armenia, Belarus, the Russian Federation, Georgia, Hungary, Kazakhstan, Latvia, Moldova, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the bands 47-48.5 MHz and 56.5-58 MHz are also allocated to the fixed and land mobile services on a secondary basis. (WRC-12)

**5.164** *Additional allocation:* in Albania, Algeria, Germany, Austria, Belgium, Bosnia and Herzegovina, Botswana, Bulgaria, Côte d'Ivoire, Croatia, Denmark, Spain, Estonia, Finland, France, Gabon, Greece, Ireland, Israel, Italy, Jordan, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Madagascar, Mali, Malta, Morocco, Mauritania, Monaco, Montenegro, Nigeria, Norway, the Netherlands, Poland, Syrian Arab Republic, Slovakia, Czech Rep., Romania, the United Kingdom, Serbia, Slovenia, Sweden, Switzerland, Swaziland, Chad, Togo, Tunisia and Turkey, the frequency band 47-68 MHz, in South Africa the frequency band 47-50 MHz, and in Latvia the frequency band 48.5-56.5 MHz, are also allocated to the land mobile service on a primary basis. However, stations of the land mobile service in the countries mentioned in connection with each frequency band referred to in this footnote shall not cause harmful interference to, or claim protection from, existing or planned broadcasting stations of countries other than those mentioned in connection with the frequency band. (WRC-15)

**5.165** *Additional allocation:* in Angola, Cameroon, Congo (Rep. of the), Madagascar, Mozambique, Niger, Somalia, Sudan, South Sudan, Tanzania and Chad, the band 47-68 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.167** *Alternative allocation:* in Bangladesh, Brunei Darussalam, India, Iran (Islamic Republic of), Pakistan and Singapore, the frequency band 50-54 MHz is allocated to the fixed, mobile and broadcasting services on a primary basis. (WRC-15)

**5.167A** *Additional allocation:* in Indonesia and Thailand, the frequency band 50-54 MHz is also allocated to the fixed, mobile and broadcasting services on a primary basis. (WRC-15)

**5.168** *Additional allocation:* in Australia, China and the Dem. People's Rep. of Korea, the band 50-54 MHz is also allocated to the broadcasting service on a primary basis.

**5.169** *Alternative allocation:* in Botswana, Lesotho, Malawi, Namibia, the Dem. Rep. of the Congo, Rwanda, South Africa, Swaziland, Zambia and Zimbabwe, the band 50-54 MHz is allocated to the amateur service on a primary basis. In Senegal, the band 50-51 MHz is allocated to the amateur service on a primary basis. (WRC-12)

**5.170** *Additional allocation:* in New Zealand, the frequency band 51-54 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-15)

**5.171** *Additional allocation:* in Botswana, Lesotho, Malawi, Mali, Namibia, Dem. Rep. of the Congo, Rwanda, South Africa, Swaziland, Zambia and Zimbabwe, the band 54-68 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.172** *Different category of service:* in the French overseas departments and communities in Region 2 and Guyana, the allocation of the frequency band 54-68 MHz to the fixed and mobile services is on a primary basis (see No. 5.33). (WRC-15)

**5.173** *Different category of service:* in the French overseas departments and communities in Region 2 and Guyana, the allocation of the frequency band 68-72 MHz to the fixed and mobile services is on a primary basis (see No. 5.33). (WRC-15)

**5.175** *Alternative allocation:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Moldova, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the bands 68-73 MHz and 76-87.5 MHz are allocated to the broadcasting service on a primary basis. In Latvia and Lithuania, the bands 68-73 MHz and 76-87.5 MHz are allocated to the broadcasting and mobile, except aeronautical mobile, services on a primary basis. The services to which these bands are allocated in other countries and the broadcasting service in the countries listed above are subject to agreements with the neighbouring countries concerned. (WRC-07)

**5.176** *Additional allocation:* in Australia, China, Korea (Rep. of), the Philippines, the Dem. People's Rep. of Korea and Samoa, the band 68-74 MHz is also allocated to the broadcasting service on a primary basis. (WRC-07)

**5.177** *Additional allocation:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 73-74 MHz is also allocated to the broadcasting service on a primary basis, subject to agreement obtained under No. 9.21. (WRC-07)

**5.178** *Additional allocation:* in Colombia, Cuba, El Salvador, Guatemala, Guyana, Honduras and Nicaragua, the band 73-74.6 MHz is also allocated to the fixed and mobile services on a secondary basis. (WRC-12)

**5.179** *Additional allocation:* in Armenia, Azerbaijan, Belarus, China, the Russian Federation, Georgia, Kazakhstan, Lithuania, Mongolia, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the bands 74.6-74.8 MHz and 75.2-75.4 MHz are also allocated to the aeronautical radionavigation service, on a primary basis, for ground-based transmitters only. (WRC-12)

**5.180** The frequency 75 MHz is assigned to marker beacons. Administrations shall refrain from assigning frequencies close to the limits of the guardband to stations of other services which, because of their power or geographical position, might cause harmful interference or otherwise place a constraint on marker beacons.

Every effort should be made to improve further the characteristics of airborne receivers and to limit the power of transmitting stations close to the limits 74.8 MHz and 75.2 MHz.

**5.181** *Additional allocation:* in Egypt, Israel and the Syrian Arab Republic, the band 74.8-75.2 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. 9.21. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedure invoked under No. 9.21.

**5.182** *Additional allocation:* in Western Samoa, the band 75.4-87 MHz is also allocated to the broadcasting service on a primary basis.

**5.183** *Additional allocation:* in China, Korea (Rep. of), Japan, the Philippines and the Dem. People's Rep. of Korea, the band 76-87 MHz is also allocated to the broadcasting service on a primary basis.

**5.185** *Different category of service:* in the United States, the French overseas departments and communities in Region 2, Guyana and Paraguay, the allocation of the frequency band 76-88 MHz to the fixed and mobile services is on a primary basis (see No. 5.33). (WRC-15)

**5.187** *Alternative allocation:* in Albania, the band 81-87.5 MHz is allocated to the broadcasting service on a primary basis and used in accordance with the decisions contained in the Final Acts of the Special Regional Conference (Geneva, 1960).

**5.188** *Additional allocation:* in Australia, the band 85-87 MHz is also allocated to the broadcasting service on a primary basis. The introduction of the broadcasting service in Australia is subject to special agreements between the administrations concerned.

**5.190** *Additional allocation:* in Monaco, the band 87.5-88 MHz is also allocated to the land mobile service on a primary basis, subject to agreement obtained under No. 9.21.

**5.192** *Additional allocation:* in China and Korea (Rep. of), the band 100-108 MHz is also allocated to the fixed and mobile services on a primary basis.

**5.194** *Additional allocation:* in Azerbaijan, Kyrgyzstan, Somalia and Turkmenistan, the band 104-108 MHz is also allocated to the mobile, except aeronautical mobile (R), service on a secondary basis. (WRC-07)

**5.197** *Additional allocation:* in the Syrian Arab Republic, the band 108-111.975 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. 9.21. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedures invoked under No. 9.21. (WRC-12)

**5.197A** *Additional allocation:* the band 108-117.975 MHz is also allocated on a primary basis to the aeronautical mobile (R) service, limited to systems operating in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution 413 (Rev.WRC-12). The use of the band 108-112 MHz by the aeronautical mobile (R) service shall be limited to systems composed of ground-based transmitters and associated receivers that provide navigational information in support of air navigation functions in accordance with recognized international aeronautical standards. (FCC)

**5.200** In the band 117.975-137 MHz, the frequency 121.5 MHz is the aeronautical emergency frequency and, where required, the frequency 123.1 MHz is the aeronautical frequency auxiliary to 121.5 MHz. Mobile stations of the maritime mobile service may communicate on these frequencies under the conditions laid down in Article 31 for distress and safety purposes with stations of the aeronautical mobile service. (WRC-07)

**5.201** *Additional allocation:* in Armenia, Azerbaijan, Belarus, Bulgaria, Estonia, the Russian Federation, Georgia, Hungary, Iran (Islamic Republic of), Iraq (Republic of), Japan, Kazakhstan, Moldova, Mongolia, Mozambique, Uzbekistan, Papua New Guinea, Poland, Kyrgyzstan, Romania, Tajikistan, Turkmenistan and Ukraine, the frequency band 132-136 MHz is also allocated to the aeronautical mobile (OR) service on a primary basis. In assigning frequencies to stations of the aeronautical mobile (OR) service, the administration shall take account of the frequencies assigned to stations in the aeronautical mobile (R) service. (WRC-15)

**5.202** *Additional allocation:* in Saudi Arabia, Armenia, Azerbaijan, Belarus, Bulgaria, the United Arab Emirates, the Russian Federation, Georgia, Iran (Islamic Republic of), Jordan, Oman, Uzbekistan, Poland, the Syrian Arab Republic, Kyrgyzstan, Romania, Tajikistan, Turkmenistan and Ukraine, the frequency band 136-137 MHz is also allocated to the aeronautical mobile (OR) service on a primary basis. In assigning frequencies to stations of the aeronautical mobile (OR) service, the administration shall take account of the frequencies assigned to stations in the aeronautical mobile (R) service. (WRC-15)

**5.204** *Different category of service:* in Afghanistan, Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, China, Cuba, the United Arab Emirates, India, Indonesia, Iran (Islamic Republic of), Iraq, Kuwait, Montenegro, Oman, Pakistan, the Philippines, Qatar, Serbia, Singapore, Thailand and Yemen, the band 137-138 MHz is allocated to the fixed and mobile, except aeronautical mobile (R), services on a primary basis (see No. 5.33). (WRC-07)

**5.205** *Different category of service:* in Israel and Jordan, the allocation of the band 137-138 MHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. 5.33).

**5.206** *Different category of service:* in Armenia, Azerbaijan, Belarus, Bulgaria, Egypt, the Russian Federation, Finland, France, Georgia, Greece, Kazakhstan, Lebanon, Moldova, Mongolia, Uzbekistan, Poland, Kyrgyzstan, the Syrian Arab Republic, Slovakia, the Czech Rep., Romania, Tajikistan, Turkmenistan and Ukraine, the allocation of the band 137-138 MHz to the aeronautical mobile (OR) service is on a primary basis (see No. 5.33).

**5.207** *Additional allocation:* in Australia, the band 137-144 MHz is also allocated to the broadcasting service on a primary basis until that service can be accommodated within regional broadcasting allocations.

**5.208** The use of the band 137-138 MHz by the mobile-satellite service is subject to coordination under No. 9.11A.

**5.208A** In making assignments to space stations in the mobile-satellite service in the bands 137-138 MHz, 387-390 MHz and 400.15-401 MHz, administrations shall take all practicable steps to protect the radio astronomy service in the bands 150.05-153 MHz, 322-328.6 MHz, 406.1-410 MHz and 608-614 MHz from harmful interference from unwanted emissions. The threshold levels of interference detrimental to the radio astronomy service are shown in the relevant ITU-R Recommendation. (WRC-07)

**5.208B** In the frequency bands:

137-138 MHz,  
387-390 MHz,  
400.15-401 MHz,  
1452-1492 MHz,  
1525-1610 MHz,  
1613.8-1626.5 MHz,  
2655-2690 MHz,  
21.4-22 GHz,

Resolution 739 (Rev.WRC-15) applies. (FCC)

**5.209** The use of the bands 137-138 MHz, 148-150.05 MHz, 399.9-400.05 MHz, 400.15-401 MHz, 454-456 MHz and 459-460 MHz by the mobile-satellite service is limited to non-geostationary-satellite systems.

**5.210** *Additional allocation:* in Italy, the Czech Rep. and the United Kingdom, the bands 138-143.6 MHz and 143.65-144 MHz are also allocated to the space research service (space-to-Earth) on a secondary basis. (WRC-07)

**5.211** *Additional allocation:* in Germany, Saudi Arabia, Austria, Bahrain, Belgium, Denmark, the United Arab Emirates, Spain, Finland, Greece, Guinea, Ireland, Israel, Kenya, Kuwait, The Former Yugoslav Republic of Macedonia, Lebanon, Liechtenstein, Luxembourg, Mali, Malta, Montenegro, Norway, the Netherlands, Qatar, Slovakia, the United Kingdom, Serbia, Slovenia, Somalia, Sweden, Switzerland, Tanzania, Tunisia and Turkey, the frequency band 138-144 MHz is also allocated to the maritime mobile and land mobile services on a primary basis. (WRC-15)

**5.212** *Alternative allocation:* in Angola, Botswana, Cameroon, the Central African Rep., Congo (Rep. of the), Gabon, Gambia, Ghana, Guinea, Iraq, Jordan, Lesotho, Liberia, Libya, Malawi, Mozambique, Namibia, Niger, Oman, Uganda, Syrian Arab Republic, the Dem. Rep. of the Congo, Rwanda, Sierra Leone,



South Africa, Swaziland, Chad, Togo, Zambia and Zimbabwe, the band 138-144 MHz is allocated to the fixed and mobile services on a primary basis. (WRC-12)

**5.213 *Additional allocation:*** in China, the band 138-144 MHz is also allocated to the radiolocation service on a primary basis.

**5.214 *Additional allocation:*** in Eritrea, Ethiopia, Kenya, The Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Somalia, Sudan, South Sudan and Tanzania, the band 138-144 MHz is also allocated to the fixed service on a primary basis. (WRC-12)

**5.216 *Additional allocation:*** in China, the band 144-146 MHz is also allocated to the aeronautical mobile (OR) service on a secondary basis.

**5.217 *Alternative allocation:*** in Afghanistan, Bangladesh, Cuba, Guyana and India, the band 146-148 MHz is allocated to the fixed and mobile services on a primary basis.

**5.218 *Additional allocation:*** the band 148-149.9 MHz is also allocated to the space operation service (Earth-to-space) on a primary basis, subject to agreement obtained under No. 9.21. The bandwidth of any individual transmission shall not exceed  $\pm 25$  kHz.

**5.219** The use of the band 148-149.9 MHz by the mobile-satellite service is subject to coordination under No. 9.11A. The mobile-satellite service shall not constrain the development and use of the fixed, mobile and space operation services in the band 148-149.9 MHz.

**5.220** The use of the frequency bands 149.9-150.05 MHz and 399.9-400.05 MHz by the mobile-satellite service is subject to coordination under No. 9.11A. (WRC-15)

**5.221** Stations of the mobile-satellite service in the frequency band 148-149.9 MHz shall not cause harmful interference to, or claim protection from, stations of the fixed or mobile services operating in accordance with the Table of Frequency Allocations in the following countries: Albania, Algeria, Germany, Saudi Arabia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Benin, Bosnia and Herzegovina, Botswana, Brunei Darussalam, Bulgaria, Cameroon, China, Cyprus, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Croatia, Cuba, Denmark, Djibouti, Egypt, the United Arab Emirates, Eritrea, Spain, Estonia, Ethiopia, the Russian Federation, Finland, France, Gabon, Georgia, Ghana, Greece, Guinea, Guinea Bissau, Hungary, India, Iran (Islamic Republic of), Ireland, Iceland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, The Former Yugoslav Republic of Macedonia, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Malaysia, Mali, Malta, Mauritania, Moldova, Mongolia, Montenegro, Mozambique, Namibia, Norway, New Zealand, Oman, Uganda, Uzbekistan, Pakistan, Panama, Papua New Guinea, Paraguay, the Netherlands, the Philippines, Poland, Portugal, Qatar, the Syrian Arab Republic, Kyrgyzstan, Dem. People's Rep. of Korea, Slovakia, Romania, the United Kingdom, Senegal, Serbia, Sierra Leone, Singapore, Slovenia, Sudan, Sri Lanka, South Africa, Sweden, Switzerland, Swaziland, Tanzania, Chad, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Ukraine, Viet Nam, Yemen, Zambia and Zimbabwe. (WRC-15)

**5.225 *Additional allocation:*** in Australia and India, the band 150.05-153 MHz is also allocated to the radio astronomy service on a primary basis.

**5.225A *Additional allocation:*** in Algeria, Armenia, Azerbaijan, Belarus, China, the Russian Federation, France, Iran (Islamic Republic of), Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, Ukraine and Viet Nam, the frequency band 154-156 MHz is also allocated to the radiolocation service on a primary basis. The usage of the frequency band 154-156 MHz by the radiolocation service shall be limited to space-object detection systems operating from terrestrial locations. The operation of stations in the radiolocation service in the frequency band 154-156 MHz shall be subject to agreement obtained under No. 9.21. For the identification of potentially affected administrations in Region 1, the instantaneous field-strength value of 12 dB( $\mu$ V/m) for 10% of the time produced at 10 m above ground level in the 25 kHz reference frequency band at the border of the territory of any other administration shall be used. For the

identification of potentially affected administrations in Region 3, the interference-to-noise ratio ( $I/N$ ) value of  $-6$  dB ( $N = -161$  dBW/4 kHz), or  $-10$  dB for applications with greater protection requirements, such as public protection and disaster relief (PPDR ( $N = -161$  dBW/4 kHz)), for 1% of the time produced at 60 m above ground level at the border of the territory of any other administration shall be used. In the frequency bands 156.7625-156.8375 MHz, 156.5125-156.5375 MHz, 161.9625-161.9875 MHz, 162.0125-162.0375 MHz, out-of-band e.i.r.p. of space surveillance radars shall not exceed  $-16$  dBW. Frequency assignments to the radiolocation service under this allocation in Ukraine shall not be used without the agreement of Moldova. (WRC-12)

**5.226** The frequency 156.525 MHz is the international distress, safety and calling frequency for the maritime mobile VHF radiotelephone service using digital selective calling (DSC). The conditions for the use of this frequency and the band 156.4875-156.5625 MHz are contained in Articles 31 and 52, and in Appendix 18.

The frequency 156.8 MHz is the international distress, safety and calling frequency for the maritime mobile VHF radiotelephone service. The conditions for the use of this frequency and the band 156.7625-156.8375 MHz are contained in Article 31 and Appendix 18.

In the bands 156-156.4875 MHz, 156.5625-156.7625 MHz, 156.8375-157.45 MHz, 160.6-160.975 MHz and 161.475-162.05 MHz, each administration shall give priority to the maritime mobile service on only such frequencies as are assigned to stations of the maritime mobile service by the administration (see Articles 31 and 52, and Appendix 18).

Any use of frequencies in these bands by stations of other services to which they are allocated should be avoided in areas where such use might cause harmful interference to the maritime mobile VHF radiocommunication service.

However, the frequencies 156.8 MHz and 156.525 MHz and the frequency bands in which priority is given to the maritime mobile service may be used for radiocommunications on inland waterways subject to agreement between interested and affected administrations and taking into account current frequency usage and existing agreements. (WRC-07)

**5.227 Additional allocation:** the bands 156.4875-156.5125 MHz and 156.5375-156.5625 MHz are also allocated to the fixed and land mobile services on a primary basis. The use of these bands by the fixed and land mobile services shall not cause harmful interference to nor claim protection from the maritime mobile VHF radiocommunication service. (WRC-07)

**5.228** The use of the frequency bands 156.7625-156.7875 MHz and 156.8125-156.8375 MHz by the mobile-satellite service (Earth-to-space) is limited to the reception of automatic identification system (AIS) emissions of long-range AIS broadcast messages (Message 27, see the most recent version of Recommendation ITU-R M.1371). With the exception of AIS emissions, emissions in these frequency bands by systems operating in the maritime mobile service for communications shall not exceed 1 W. (WRC-12)

**5.228A** The frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz may be used by aircraft stations for the purpose of search and rescue operations and other safety-related communications. (WRC-12)

**5.228AA** The use of the frequency bands 161.9375-161.9625 MHz and 161.9875-162.0125 MHz by the maritime mobile-satellite (Earth-to-space) service is limited to the systems which operate in accordance with Appendix 18. (WRC-15)

**5.228B** The use of the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the fixed and land mobile services shall not cause harmful interference to, or claim protection from, the maritime mobile service. (WRC-12)

**5.228C** The use of the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the maritime mobile service and the mobile-satellite (Earth-to-space) service is limited to the automatic

identification system (AIS). The use of these frequency bands by the aeronautical mobile (OR) service is limited to AIS emissions from search and rescue aircraft operations. The AIS operations in these frequency bands shall not constrain the development and use of the fixed and mobile services operating in the adjacent frequency bands. (WRC-12)

**5.228D** The frequency bands 161.9625-161.9875 MHz (AIS 1) and 162.0125-162.0375 MHz (AIS 2) may continue to be used by the fixed and mobile services on a primary basis until 1 January 2025, at which time this allocation shall no longer be valid. Administrations are encouraged to make all practicable efforts to discontinue the use of these bands by the fixed and mobile services prior to the transition date. During this transition period, the maritime mobile service in these frequency bands has priority over the fixed, land mobile and aeronautical mobile services. (WRC-12)

**5.228E** The use of the automatic identification system in the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the aeronautical mobile (OR) service is limited to aircraft stations for the purpose of search and rescue operations and other safety-related communications. (WRC-12)

**5.228F** The use of the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the mobile-satellite service (Earth-to-space) is limited to the reception of automatic identification system emissions from stations operating in the maritime mobile service. (WRC-12)

**5.229** *Alternative allocation:* in Morocco, the band 162-174 MHz is allocated to the broadcasting service on a primary basis. The use of this band shall be subject to agreement with administrations having services, operating or planned, in accordance with the Table which are likely to be affected. Stations in existence on 1 January 1981, with their technical characteristics as of that date, are not affected by such agreement.

**5.230** *Additional allocation:* in China, the band 163-167 MHz is also allocated to the space operation service (space-to-Earth) on a primary basis, subject to agreement obtained under No. 9.21.

**5.231** *Additional allocation:* in Afghanistan and China, the band 167-174 MHz is also allocated to the broadcasting service on a primary basis. The introduction of the broadcasting service into this band shall be subject to agreement with the neighbouring countries in Region 3 whose services are likely to be affected. (WRC-12)

**5.233** *Additional allocation:* in China, the band 174-184 MHz is also allocated to the space research (space-to-Earth) and the space operation (space-to-Earth) services on a primary basis, subject to agreement obtained under No. 9.21. These services shall not cause harmful interference to, or claim protection from, existing or planned broadcasting stations.

**5.235** *Additional allocation:* in Germany, Austria, Belgium, Denmark, Spain, Finland, France, Israel, Italy, Liechtenstein, Malta, Monaco, Norway, the Netherlands, the United Kingdom, Sweden and Switzerland, the band 174-223 MHz is also allocated to the land mobile service on a primary basis. However, the stations of the land mobile service shall not cause harmful interference to, or claim protection from, broadcasting stations, existing or planned, in countries other than those listed in this footnote.

**5.237** *Additional allocation:* in Congo (Rep. of the), Egypt, Eritrea, Ethiopia, Gambia, Guinea, Libya, Mali, Sierra Leone, Somalia and Chad, the band 174-223 MHz is also allocated to the fixed and mobile services on a secondary basis. (WRC-12)

**5.238** *Additional allocation:* in Bangladesh, India, Pakistan and the Philippines, the band 200-216 MHz is also allocated to the aeronautical radionavigation service on a primary basis.

**5.240** *Additional allocation:* in China and India, the band 216-223 MHz is also allocated to the aeronautical radionavigation service on a primary basis and to the radiolocation service on a secondary basis.

**5.241** In Region 2, no new stations in the radiolocation service may be authorized in the band 216-225 MHz. Stations authorized prior to 1 January 1990 may continue to operate on a secondary basis.

**5.242 Additional allocation:** in Canada, the band 216-220 MHz is also allocated to the land mobile service on a primary basis.

**5.243 Additional allocation:** in Somalia, the band 216-225 MHz is also allocated to the aeronautical radionavigation service on a primary basis, subject to not causing harmful interference to existing or planned broadcasting services in other countries.

**5.245 Additional allocation:** in Japan, the band 222-223 MHz is also allocated to the aeronautical radionavigation service on a primary basis and to the radiolocation service on a secondary basis.

**5.246 Alternative allocation:** in Spain, France, Israel and Monaco, the band 223-230 MHz is allocated to the broadcasting and land mobile services on a primary basis (see No. 5.33) on the basis that, in the preparation of frequency plans, the broadcasting service shall have prior choice of frequencies; and allocated to the fixed and mobile, except land mobile, services on a secondary basis. However, the stations of the land mobile service shall not cause harmful interference to, or claim protection from, existing or planned broadcasting stations in Morocco and Algeria.

**5.247 Additional allocation:** in Saudi Arabia, Bahrain, the United Arab Emirates, Jordan, Oman, Qatar and Syrian Arab Republic, the band 223-235 MHz is also allocated to the aeronautical radionavigation service on a primary basis.

**5.250 Additional allocation:** in China, the band 225-235 MHz is also allocated to the radio astronomy service on a secondary basis.

**5.251 Additional allocation:** in Nigeria, the band 230-235 MHz is also allocated to the aeronautical radionavigation service on a primary basis, subject to agreement obtained under No. 9.21.

**5.252 Alternative allocation:** in Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe, the bands 230-238 MHz and 246-254 MHz are allocated to the broadcasting service on a primary basis, subject to agreement obtained under No. 9.21.

**5.254** The bands 235-322 MHz and 335.4-399.9 MHz may be used by the mobile-satellite service, subject to agreement obtained under No. 9.21, on condition that stations in this service do not cause harmful interference to those of other services operating or planned to be operated in accordance with the Table of Frequency Allocations except for the additional allocation made in footnote No. 5.256A.

**5.255** The bands 312-315 MHz (Earth-to-space) and 387-390 MHz (space-to-Earth) in the mobile-satellite service may also be used by non-geostationary-satellite systems. Such use is subject to coordination under No. 9.11A.

**5.256** The frequency 243 MHz is the frequency in this band for use by survival craft stations and equipment used for survival purposes. (WRC-07)

**5.256A Additional allocation:** in China, the Russian Federation and Kazakhstan, the frequency band 258-261 MHz is also allocated to the space research service (Earth-to-space) and space operation service (Earth-to-space) on a primary basis. Stations in the space research service (Earth-to-space) and space operation service (Earth-to-space) shall not cause harmful interference to, or claim protection from, or constrain the use and development of, the mobile service systems and mobile-satellite service systems operating in the frequency band. Stations in space research service (Earth-to-space) and space operation service (Earth-to-space) shall not constrain the future development of fixed service systems of other countries. (WRC-15)

**5.257** The band 267-272 MHz may be used by administrations for space telemetry in their countries on a primary basis, subject to agreement obtained under No. 9.21.

**5.258** The use of the band 328.6-335.4 MHz by the aeronautical radionavigation service is limited to Instrument Landing Systems (glide path).

**5.259 Additional allocation:** in Egypt and the Syrian Arab Republic, the band 328.6-335.4 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. 9.21. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedure invoked under No. 9.21. (WRC-12)

**5.261** Emissions shall be confined in a band of  $\pm 25$  kHz about the standard frequency 400.1 MHz.

**5.262 Additional allocation:** in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, Botswana, Colombia, Cuba, Egypt, the United Arab Emirates, Ecuador, the Russian Federation, Georgia, Hungary, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kuwait, Liberia, Malaysia, Moldova, Oman, Uzbekistan, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, Kyrgyzstan, Singapore, Somalia, Tajikistan, Chad, Turkmenistan and Ukraine, the band 400.05-401 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

**5.263** The band 400.15-401 MHz is also allocated to the space research service in the space-to-space direction for communications with manned space vehicles. In this application, the space research service will not be regarded as a safety service.

**5.264** The use of the band 400.15-401 MHz by the mobile-satellite service is subject to coordination under No. 9.11A. The power flux-density limit indicated in Annex 1 of Appendix 5 shall apply until such time as a competent world radiocommunication conference revises it.

**5.265** In the frequency band 403-410 MHz, Resolution 205 (Rev.WRC-15) applies. (WRC-15)

**5.266** The use of the band 406-406.1 MHz by the mobile-satellite service is limited to low power satellite emergency position-indicating radiobeacons (see also Article 31). (WRC-07)

**5.267** Any emission capable of causing harmful interference to the authorized uses of the band 406-406.1 MHz is prohibited.

**5.268** Use of the frequency band 410-420 MHz by the space research service is limited to space-to-space communication links with an orbiting, manned space vehicle. The power flux-density at the surface of the Earth produced by emissions from transmitting stations of the space research service (space-to-space) in the frequency band 410-420 MHz shall not exceed  $-153$  dB(W/m<sup>2</sup>) for  $0^\circ \leq \delta \leq 5^\circ$ ,  $-153 + 0.077 (\delta - 5)$  dB(W/m<sup>2</sup>) for  $5^\circ \leq \delta \leq 70^\circ$  and  $-148$  dB(W/m<sup>2</sup>) for  $70^\circ \leq \delta \leq 90^\circ$ , where  $\delta$  is the angle of arrival of the radio-frequency wave and the reference bandwidth is 4 kHz. In this frequency band, stations of the space research service (space-to-space) shall not claim protection from, nor constrain the use and development of, stations of the fixed and mobile services. No. 4.10 does not apply. (WRC-15)

**5.269 Different category of service:** in Australia, the United States, India, Japan and the United Kingdom, the allocation of the bands 420-430 MHz and 440-450 MHz to the radiolocation service is on a primary basis (see No. 5.33).

**5.270 Additional allocation:** in Australia, the United States, Jamaica and the Philippines, the bands 420-430 MHz and 440-450 MHz are also allocated to the amateur service on a secondary basis.

**5.271 Additional allocation:** in Belarus, China, India, Kyrgyzstan and Turkmenistan, the band 420-460 MHz is also allocated to the aeronautical radionavigation service (radio altimeters) on a secondary basis. (WRC-07)

**5.274 Alternative allocation:** in Denmark, Norway, Sweden and Chad, the bands 430-432 MHz and 438-440 MHz are allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.275 Additional allocation:** in Croatia, Estonia, Finland, Libya, The Former Yugoslav Republic of Macedonia, Montenegro and Serbia, the frequency bands 430-432 MHz and 438-440 MHz are also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-15)

**5.276 Additional allocation:** in Afghanistan, Algeria, Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Burkina Faso, Djibouti, Egypt, the United Arab Emirates, Ecuador, Eritrea, Ethiopia, Greece, Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Italy, Jordan, Kenya, Kuwait, Libya, Malaysia, Niger, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, Switzerland, Thailand, Togo, Turkey and Yemen, the frequency band 430-440 MHz is also allocated to the fixed service on a primary basis and the frequency bands 430-435 MHz and 438-440 MHz are also allocated, except in Ecuador, to the mobile, except aeronautical mobile, service on a primary basis. (WRC-15)

**5.277 Additional allocation:** in Angola, Armenia, Azerbaijan, Belarus, Cameroon, Congo (Rep. of the), Djibouti, the Russian Federation, Georgia, Hungary, Israel, Kazakhstan, Mali, Mongolia, Uzbekistan, Poland, the Dem. Rep. of the Congo, Kyrgyzstan, Slovakia, Romania, Rwanda, Tajikistan, Chad, Turkmenistan and Ukraine, the band 430-440 MHz is also allocated to the fixed service on a primary basis. (WRC-12)

**5.278 Different category of service:** in Argentina, Colombia, Costa Rica, Cuba, Guyana, Honduras, Panama and Venezuela, the allocation of the band 430-440 MHz to the amateur service is on a primary basis (see No. 5.33).

**5.279 Additional allocation:** in Mexico, the bands 430-435 MHz and 438-440 MHz are also allocated on a primary basis to the land mobile service, subject to agreement obtained under No. 9.21.

**5.279A** The use of the frequency band 432-438 MHz by sensors in the Earth exploration-satellite service (active) shall be in accordance with Recommendation ITU-R RS.1260-1. Additionally, the Earth exploration-satellite service (active) in the frequency band 432-438 MHz shall not cause harmful interference to the aeronautical radionavigation service in China. The provisions of this footnote in no way diminish the obligation of the Earth exploration-satellite service (active) to operate as a secondary service in accordance with Nos. 5.29 and 5.30. (WRC-15)

**5.280** In Germany, Austria, Bosnia and Herzegovina, Croatia, The Former Yugoslav Republic of Macedonia, Liechtenstein, Montenegro, Portugal, Serbia, Slovenia and Switzerland, the band 433.05-434.79 MHz (centre frequency 433.92 MHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services of these countries operating within this band must accept harmful interference which may be caused by these applications. ISM equipment operating in this band is subject to the provisions of No. 15.13. (WRC-07)

**5.281 Additional allocation:** in the French overseas departments and communities in Region 2 and India, the band 433.75-434.25 MHz is also allocated to the space operation service (Earth-to-space) on a primary basis. In France and in Brazil, the band is allocated to the same service on a secondary basis.

**5.282** In the bands 435-438 MHz, 1260-1270 MHz, 2400-2450 MHz, 3400-3410 MHz (in Regions 2 and 3 only) and 5650-5670 MHz, the amateur-satellite service may operate subject to not causing harmful interference to other services operating in accordance with the Table (see No. 5.43). Administrations authorizing such use shall ensure that any harmful interference caused by emissions from a station in the amateur-satellite service is immediately eliminated in accordance with the provisions of No. 25.11. The use of the bands 1260-1270 MHz and 5650-5670 MHz by the amateur-satellite service is limited to the Earth-to-space direction.

**5.283 Additional allocation:** in Austria, the band 438-440 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

**5.284** *Additional allocation:* in Canada, the band 440-450 MHz is also allocated to the amateur service on a secondary basis.

**5.285** *Different category of service:* in Canada, the allocation of the band 440-450 MHz to the radiolocation service is on a primary basis (see No. 5.33).

**5.286** The band 449.75-450.25 MHz may be used for the space operation service (Earth-to-space) and the space research service (Earth-to-space), subject to agreement obtained under No. 9.21.

**5.286A** The use of the bands 454-456 MHz and 459-460 MHz by the mobile-satellite service is subject to coordination under No. 9.11A.

**5.286AA** The frequency band 450-470 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). See Resolution 224 (Rev.WRC-15). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.286B** The use of the band 454-455 MHz in the countries listed in No. 5.286D, 455-456 MHz and 459-460 MHz in Region 2, and 454-456 MHz and 459-460 MHz in the countries listed in No. 5.286E, by stations in the mobile-satellite service, shall not cause harmful interference to, or claim protection from, stations of the fixed or mobile services operating in accordance with the Table of Frequency Allocations.

**5.286C** The use of the band 454-455 MHz in the countries listed in No. 5.286D, 455-456 MHz and 459-460 MHz in Region 2, and 454-456 MHz and 459-460 MHz in the countries listed in No. 5.286E, by stations in the mobile-satellite service, shall not constrain the development and use of the fixed and mobile services operating in accordance with the Table of Frequency Allocations.

**5.286D** *Additional allocation:* in Canada, the United States and Panama, the band 454-455 MHz is also allocated to the mobile-satellite service (Earth-to-space) on a primary basis. (WRC-07)

**5.286E** *Additional allocation:* in Cape Verde, Nepal and Nigeria, the bands 454-456 MHz and 459-460 MHz are also allocated to the mobile-satellite (Earth-to-space) service on a primary basis. (WRC-07)

**5.287** Use of the frequency bands 457.5125-457.5875 MHz and 467.5125-467.5875 MHz by the maritime mobile service is limited to on-board communication stations. The characteristics of the equipment and the channelling arrangement shall be in accordance with Recommendation ITU-R M.1174-3. The use of these frequency bands in territorial waters is subject to the national regulations of the administration concerned. (WRC-15)

**5.288** In the territorial waters of the United States and the Philippines, the preferred frequencies for use by on-board communication stations shall be 457.525 MHz, 457.550 MHz, 457.575 MHz and 457.600 MHz paired, respectively, with 467.750 MHz, 467.775 MHz, 467.800 MHz and 467.825 MHz. The characteristics of the equipment used shall conform to those specified in Recommendation ITU-R M.1174-3. (WRC-15)

**5.289** Earth exploration-satellite service applications, other than the meteorological-satellite service, may also be used in the bands 460-470 MHz and 1690-1710 MHz for space-to-Earth transmissions subject to not causing harmful interference to stations operating in accordance with the Table.

**5.290** *Different category of service:* in Afghanistan, Azerbaijan, Belarus, China, the Russian Federation, Japan, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 460-470 MHz to the meteorological-satellite service (space-to-Earth) is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. (WRC-12)

**5.291** *Additional allocation:* in China, the band 470-485 MHz is also allocated to the space research (space-to-Earth) and the space operation (space-to-Earth) services on a primary basis subject to agreement obtained under No. 9.21 and subject to not causing harmful interference to existing and planned

broadcasting stations.

**5.291A** *Additional allocation:* in Germany, Austria, Denmark, Estonia, Liechtenstein, the Czech Rep., Serbia and Switzerland, the frequency band 470-494 MHz is also allocated to the radiolocation service on a secondary basis. This use is limited to the operation of wind profiler radars in accordance with Resolution 217 (WRC-97). (WRC-15)

**5.292** *Different category of service:* in Argentina, Uruguay and Venezuela, the allocation of the frequency band 470-512 MHz to the mobile service is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. (WRC-15)

**5.293** *Different category of service:* in Canada, Chile, Cuba, the United States, Guyana, Jamaica and Panama, the allocation of the frequency bands 470-512 MHz and 614-806 MHz to the fixed service is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. In the Bahamas, Barbados, Canada, Chile, Cuba, the United States, Guyana, Jamaica, Mexico and Panama, the allocation of the frequency bands 470-512 MHz and 614-698 MHz to the mobile service is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. In Argentina and Ecuador, the allocation of the frequency band 470-512 MHz to the fixed and mobile services is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. (WRC-15)

**5.294** *Additional allocation:* in Saudi Arabia, Cameroon, Côte d'Ivoire, Egypt, Ethiopia, Israel, Libya, the Syrian Arab Republic, Chad and Yemen, the frequency band 470-582 MHz is also allocated to the fixed service on a secondary basis. (WRC-15)

**5.295** In the Bahamas, Barbados, Canada, the United States and Mexico, the frequency band 470-608 MHz, or portions thereof, is identified for International Mobile Telecommunications (IMT) – see Resolution 224 (Rev.WRC-15). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Mobile service stations of the IMT system within the frequency band are subject to agreement obtained under No. 9.21 and shall not cause harmful interference to, or claim protection from, the broadcasting service of neighbouring countries. Nos. 5.43 and 5.43A apply. In Mexico, the use of IMT in this frequency band will not start before 31 December 2018 and may be extended if agreed by the neighbouring countries. (WRC-15)

**5.296** *Additional allocation:* in Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, The Former Yugoslav Republic of Macedonia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Swaziland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-15)

**5.296A** In Micronesia, the Solomon Islands, Tuvalu and Vanuatu, the frequency band 470-698 MHz, or portions thereof, and in Bangladesh, Maldives and New Zealand, the frequency band 610-698 MHz, or portions thereof, are identified for use by these administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolution 224 (Rev.WRC-15). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does



not establish priority in the Radio Regulations. The mobile allocation in this frequency band shall not be used for IMT systems unless subject to agreement obtained under No. 9.21 and shall not cause harmful interference to, or claim protection from, the broadcasting service of neighbouring countries. Nos. 5.43 and 5.43A apply. (WRC-15)

**5.297 *Additional allocation:*** in Canada, Costa Rica, Cuba, El Salvador, the United States, Guatemala, Guyana and Jamaica, the frequency band 512-608 MHz is also allocated to the fixed and mobile services on a primary basis, subject to agreement obtained under No. 9.21. In the Bahamas, Barbados and Mexico, the frequency band 512-608 MHz is also allocated to the mobile service on a primary basis, subject to agreement obtained under No. 9.21. (WRC-15)

**5.298 *Additional allocation:*** in India, the band 549.75-550.25 MHz is also allocated to the space operation service (space-to-Earth) on a secondary basis.

**5.300 *Additional allocation:*** in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic and Sudan, the frequency band 582-790 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis. (WRC-15)

**5.304 *Additional allocation:*** in the African Broadcasting Area (see Nos. 5.10 to 5.13), the band 606-614 MHz is also allocated to the radio astronomy service on a primary basis.

**5.305 *Additional allocation:*** in China, the band 606-614 MHz is also allocated to the radio astronomy service on a primary basis.

**5.306 *Additional allocation:*** in Region 1, except in the African Broadcasting Area (see Nos. 5.10 to 5.13), and in Region 3, the band 608-614 MHz is also allocated to the radio astronomy service on a secondary basis.

**5.307 *Additional allocation:*** in India, the band 608-614 MHz is also allocated to the radio astronomy service on a primary basis.

**5.308 *Additional allocation:*** in Belize and Colombia, the frequency band 614-698 MHz is also allocated to the mobile service on a primary basis. Stations of the mobile service within the frequency band are subject to agreement obtained under No. 9.21. (WRC-15)

**5.308A** In the Bahamas, Barbados, Belize, Canada, Colombia, the United States and Mexico, the frequency band 614-698 MHz, or portions thereof, is identified for International Mobile Telecommunications (IMT) – see Resolution 224 (Rev.WRC-15). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Mobile service stations of the IMT system within the frequency band are subject to agreement obtained under No. 9.21 and shall not cause harmful interference to or claim protection from the broadcasting service of neighbouring countries. Nos. 5.43 and 5.43A apply. In Belize and Mexico, the use of IMT in this frequency band will not start before 31 December 2018 and may be extended if agreed by the neighbouring countries. (WRC-15)

**5.309 *Different category of service:*** in El Salvador, the allocation of the frequency band 614-806 MHz to the fixed service is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. (WRC-15)

**5.311A** For the frequency band 620-790 MHz, see also Resolution 549 (WRC-07). (WRC-07)

**5.312 *Additional allocation:*** in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the frequency band 645-862 MHz, in Bulgaria the frequency bands 646-686 MHz, 726-758 MHz, 766-814 MHz and 822-862 MHz, and in Poland the frequency band 860-862 MHz until 31 December 2017, are also allocated to the aeronautical radionavigation service on a primary basis. (WRC-15)

**5.312A** In Region 1, the use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution 760 (WRC-15). See also Resolution 224 (Rev.WRC-15). (WRC-15)

**5.313A** The frequency band, or portions of the frequency band 698-790 MHz, in Australia, Bangladesh, Brunei Darussalam, Cambodia, China, Korea (Rep. of), Fiji, India, Indonesia, Japan, Kiribati, Lao P.D.R., Malaysia, Myanmar (Union of), New Zealand, Pakistan, Papua New Guinea, the Philippines, Solomon Islands, Samoa, Singapore, Thailand, Tonga, Tuvalu, Vanuatu and Viet Nam, are identified for use by these administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. In China, the use of IMT in this frequency band will not start until 2015. (WRC-15)

**5.316B** In Region 1, the allocation to the mobile, except aeronautical mobile, service in the frequency band 790-862 MHz is subject to agreement obtained under No. 9.21 with respect to the aeronautical radionavigation service in countries mentioned in No. 5.312. For countries party to the GE06 Agreement, the use of stations of the mobile service is also subject to the successful application of the procedures of that Agreement. Resolutions 224 (Rev.WRC-15) and 749 (Rev.WRC-15) shall apply, as appropriate. (WRC-15)

**5.317** *Additional allocation:* in Region 2 (except Brazil, the United States and Mexico), the frequency band 806-890 MHz is also allocated to the mobile-satellite service on a primary basis, subject to agreement obtained under No. 9.21. The use of this service is intended for operation within national boundaries. (WRC-15)

**5.317A** The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands 694-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions 224 (Rev.WRC-15), 760 (WRC-15) and 749 (Rev.WRC-15), where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.318** *Additional allocation:* in Canada, the United States and Mexico, the bands 849-851 MHz and 894-896 MHz are also allocated to the aeronautical mobile service on a primary basis, for public correspondence with aircraft. The use of the band 849-851 MHz is limited to transmissions from aeronautical stations and the use of the band 894-896 MHz is limited to transmissions from aircraft stations.

**5.319** *Additional allocation:* in Belarus, the Russian Federation and Ukraine, the bands 806-840 MHz (Earth-to-space) and 856-890 MHz (space-to-Earth) are also allocated to the mobile-satellite, except aeronautical mobile-satellite (R), service. The use of these bands by this service shall not cause harmful interference to, or claim protection from, services in other countries operating in accordance with the Table of Frequency Allocations and is subject to special agreements between the administrations concerned.

**5.320** *Additional allocation:* in Region 3, the bands 806-890 MHz and 942-960 MHz are also allocated to the mobile-satellite, except aeronautical mobile-satellite (R), service on a primary basis, subject to agreement obtained under No. 9.21. The use of this service is limited to operation within national boundaries. In seeking such agreement, appropriate protection shall be afforded to services operating in accordance with the Table, to ensure that no harmful interference is caused to such services.

**5.322** In Region 1, in the band 862-960 MHz, stations of the broadcasting service shall be operated only in the African Broadcasting Area (see Nos. 5.10 to 5.13) excluding Algeria, Burundi, Egypt, Spain, Lesotho, Libya, Morocco, Malawi, Namibia, Nigeria, South Africa, Tanzania, Zimbabwe and Zambia, subject to agreement obtained under No. 9.21. (WRC-12)

**5.323 Additional allocation:** in Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 862-960 MHz, in Bulgaria the bands 862-890.2 MHz and 900-935.2 MHz, in Poland the band 862-876 MHz until 31 December 2017, and in Romania the bands 862-880 MHz and 915-925 MHz, are also allocated to the aeronautical radionavigation service on a primary basis. Such use is subject to agreement obtained under No. 9.21 with administrations concerned and limited to ground-based radiobeacons in operation on 27 October 1997 until the end of their lifetime. (WRC-12)

**5.325 Different category of service:** in the United States, the allocation of the band 890-942 MHz to the radiolocation service is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21.

**5.325A Different category of service:** in Argentina, Brazil, Costa Rica, Cuba, Dominican Republic, El Salvador, Ecuador, the French overseas departments and communities in Region 2, Guatemala, Mexico, Paraguay, Uruguay and Venezuela, the frequency band 902-928 MHz is allocated to the land mobile service on a primary basis. In Colombia, the frequency band 902-905 MHz is allocated to the land mobile service on a primary basis. (WRC-15)

**5.326 Different category of service:** in Chile, the band 903-905 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement obtained under No. 9.21.

**5.327 Different category of service:** in Australia, the allocation of the band 915-928 MHz to the radiolocation service is on a primary basis (see No. 5.33).

**5.327A** The use of the frequency band 960-1164 MHz by the aeronautical mobile (R) service is limited to systems that operate in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution 417 (Rev.WRC-15). (WRC-15)

**5.328** The use of the band 960-1215 MHz by the aeronautical radionavigation service is reserved on a worldwide basis for the operation and development of airborne electronic aids to air navigation and any directly associated ground-based facilities.

**5.328A** Stations in the radionavigation-satellite service in the band 1164-1215 MHz shall operate in accordance with the provisions of Resolution 609 (Rev.WRC-07) and shall not claim protection from stations in the aeronautical radionavigation service in the band 960-1215 MHz. No. 5.43A does not apply. The provisions of No. 21.18 shall apply. (WRC-07)

**5.328AA** The frequency band 1087.7-1092.3 MHz is also allocated to the aeronautical mobile-satellite (R) service (Earth-to-space) on a primary basis, limited to the space station reception of Automatic Dependent Surveillance-Broadcast (ADS-B) emissions from aircraft transmitters that operate in accordance with recognized international aeronautical standards. Stations operating in the aeronautical mobile-satellite (R) service shall not claim protection from stations operating in the aeronautical radionavigation service. Resolution 425 (WRC-15) shall apply. (WRC-15)

**5.328B** The use of the bands 1164-1300 MHz, 1559-1610 MHz and 5010-5030 MHz by systems and networks in the radionavigation-satellite service for which complete coordination or notification information, as appropriate, is received by the Radiocommunication Bureau after 1 January 2005 is subject to the application of the provisions of Nos. 9.12, 9.12A and 9.13. Resolution 610 (WRC-03) shall also apply; however, in the case of radionavigation-satellite service (space-to-space) networks and systems, Resolution 610 (WRC-03) shall only apply to transmitting space stations. In accordance with No. 5.329A, for systems and networks in the radionavigation-satellite service (space-to-space) in the bands 1215-1300 MHz and 1559-1610 MHz, the provisions of Nos. 9.7, 9.12, 9.12A and 9.13 shall only apply with respect to other systems and networks in the radionavigation-satellite service (space-to-space). (WRC-07)

**5.329** Use of the radionavigation-satellite service in the band 1215-1300 MHz shall be subject to the condition that no harmful interference is caused to, and no protection is claimed from, the radionavigation service authorized under No. 5.331. Furthermore, the use of the radionavigation-satellite service in the

band 1215-1300 MHz shall be subject to the condition that no harmful interference is caused to the radiolocation service. No. 5.43 shall not apply in respect of the radiolocation service. Resolution 608 (Rev.WRC-15) shall apply. (FCC)

**5.329A** Use of systems in the radionavigation-satellite service (space-to-space) operating in the bands 1215-1300 MHz and 1559-1610 MHz is not intended to provide safety service applications, and shall not impose any additional constraints on radionavigation-satellite service (space-to-Earth) systems or on other services operating in accordance with the Table of Frequency Allocations. (WRC-07)

**5.330** *Additional allocation:* in Angola, Saudi Arabia, Bahrain, Bangladesh, Cameroon, China, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Guyana, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Nepal, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the band 1215-1300 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

**5.331** *Additional allocation:* in Algeria, Germany, Saudi Arabia, Australia, Austria, Bahrain, Belarus, Belgium, Benin, Bosnia and Herzegovina, Brazil, Burkina Faso, Burundi, Cameroon, China, Korea (Rep. of), Croatia, Denmark, Egypt, the United Arab Emirates, Estonia, the Russian Federation, Finland, France, Ghana, Greece, Guinea, Equatorial Guinea, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Jordan, Kenya, Kuwait, The Former Yugoslav Republic of Macedonia, Lesotho, Latvia, Lebanon, Liechtenstein, Lithuania, Luxembourg, Madagascar, Mali, Mauritania, Montenegro, Nigeria, Norway, Oman, Pakistan, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Dem. People's Rep. of Korea, Slovakia, the United Kingdom, Serbia, Slovenia, Somalia, Sudan, South Sudan, Sri Lanka, South Africa, Sweden, Switzerland, Thailand, Togo, Turkey, Venezuela and Viet Nam, the band 1215-1300 MHz is also allocated to the radionavigation service on a primary basis. In Canada and the United States, the band 1240-1300 MHz is also allocated to the radionavigation service, and use of the radionavigation service shall be limited to the aeronautical radionavigation service. (WRC-12)

**5.332** In the band 1215-1260 MHz, active spaceborne sensors in the Earth exploration-satellite and space research services shall not cause harmful interference to, claim protection from, or otherwise impose constraints on operation or development of the radiolocation service, the radionavigation-satellite service and other services allocated on a primary basis.

**5.334** *Additional allocation:* in Canada and the United States, the band 1350-1370 MHz is also allocated to the aeronautical radionavigation service on a primary basis.

**5.335** In Canada and the United States in the band 1240-1300 MHz, active spaceborne sensors in the Earth exploration-satellite and space research services shall not cause interference to, claim protection from, or otherwise impose constraints on operation or development of the aeronautical radionavigation service.

**5.335A** In the band 1260-1300 MHz, active spaceborne sensors in the Earth exploration-satellite and space research services shall not cause harmful interference to, claim protection from, or otherwise impose constraints on operation or development of the radiolocation service and other services allocated by footnotes on a primary basis.

**5.337** The use of the bands 1300-1350 MHz, 2700-2900 MHz and 9000-9200 MHz by the aeronautical radionavigation service is restricted to ground-based radars and to associated airborne transponders which transmit only on frequencies in these bands and only when actuated by radars operating in the same band.

**5.337A** The use of the band 1300-1350 MHz by earth stations in the radionavigation-satellite service and by stations in the radiolocation service shall not cause harmful interference to, nor constrain the operation and development of, the aeronautical-radionavigation service.

**5.338** In Kyrgyzstan, Slovakia and Turkmenistan, existing installations of the radionavigation service may continue to operate in the band 1350-1400 MHz. (WRC-12)

**5.338A** In the frequency bands 1350-1400 MHz, 1427-1452 MHz, 22.55-23.55 GHz, 30-31.3 GHz, 49.7-

50.2 GHz, 50.4-50.9 GHz, 51.4-52.6 GHz, 81-86 GHz and 92-94 GHz, Resolution 750 (Rev.WRC-15) applies. (WRC-15)

**5.339** The bands 1370-1400 MHz, 2640-2655 MHz, 4950-4990 MHz and 15.20-15.35 GHz are also allocated to the space research (passive) and Earth exploration-satellite (passive) services on a secondary basis.

**5.340** All emissions are prohibited in the following bands:

1400-1427 MHz,  
2690-2700 MHz, except those provided for by No. 5.422,  
10.68-10.7 GHz, except those provided for by No. 5.483,  
15.35-15.4 GHz, except those provided for by No. 5.511,  
23.6-24 GHz,  
31.3-31.5 GHz,  
31.5-31.8 GHz, in Region 2,  
48.94-49.04 GHz, from airborne stations  
50.2-50.4 GHz<sup>2</sup>,  
52.6-54.25 GHz,  
86-92 GHz,  
100-102 GHz,  
109.5-111.8 GHz,  
114.25-116 GHz,  
148.5-151.5 GHz,  
164-167 GHz,  
182-185 GHz,  
190-191.8 GHz,  
200-209 GHz,  
226-231.5 GHz,  
250-252 GHz.

**5.341** In the bands 1400-1727 MHz, 101-120 GHz and 197-220 GHz, passive research is being conducted by some countries in a programme for the search for intentional emissions of extraterrestrial origin.

**5.341A** In Region 1, the frequency bands 1427-1452 MHz and 1492-1518 MHz are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-15). This identification does not preclude the use of these frequency bands by any other application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of IMT stations is subject to agreement obtained under No. 9.21 with respect to the aeronautical mobile service used for aeronautical telemetry in accordance with No. 5.342. (WRC-15)

**5.341B** In Region 2, the frequency band 1427-1518 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-15). This identification does not preclude the use of this frequency band by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.341C** The frequency bands 1427-1452 MHz and 1492-1518 MHz are identified for use by

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<sup>2</sup> **5.340.1** The allocation to the Earth exploration-satellite service (passive) and the space research service (passive) in the band 50.2-50.4 GHz should not impose undue constraints on the use of the adjacent bands by the primary allocated services in those bands.

administrations in Region 3 wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-15). The use of these frequency bands by the above administrations for the implementation of IMT in the frequency bands 1429-1452 MHz and 1492-1518 MHz is subject to agreement obtained under No. 9.21 from countries using stations of the aeronautical mobile service. This identification does not preclude the use of these frequency bands by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.342** *Additional allocation:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Uzbekistan, Kyrgyzstan and Ukraine, the frequency band 1429-1535 MHz is also allocated to the aeronautical mobile service on a primary basis, exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the frequency band 1452-1492 MHz is subject to agreement between the administrations concerned. (WRC-15)

**5.343** In Region 2, the use of the band 1435-1535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service.

**5.344** *Alternative allocation:* in the United States, the band 1452-1525 MHz is allocated to the fixed and mobile services on a primary basis (see also No. 5.343).

**5.345** Use of the band 1452-1492 MHz by the broadcasting-satellite service, and by the broadcasting service, is limited to digital audio broadcasting and is subject to the provisions of Resolution 528 (Rev.WRC-15). (FCC)

**5.346** In Algeria, Angola, Saudi Arabia, Bahrain, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo (Rep. of the), Côte d'Ivoire, Djibouti, Egypt, United Arab Emirates, Gabon, Gambia, Ghana, Guinea, Iraq, Jordan, Kenya, Kuwait, Lesotho, Lebanon, Liberia, Madagascar, Malawi, Mali, Morocco, Mauritius, Mauritania, Mozambique, Namibia, Niger, Nigeria, Oman, Uganda, Palestine, Qatar, Dem. Rep. of the Congo, Rwanda, Senegal, Seychelles, Sudan, South Sudan, South Africa, Swaziland, Tanzania, Chad, Togo, Tunisia, Zambia, and Zimbabwe, the frequency band 1452-1492 MHz is identified for use by administrations listed above wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-15). This identification does not preclude the use of this frequency band by any other application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of this frequency band for the implementation of IMT is subject to agreement obtained under No. 9.21 with respect to the aeronautical mobile service used for aeronautical telemetry in accordance with No. 5.342. See also Resolution 761 (WRC-15). (WRC-15)

NOTE: The use by Palestine of the allocation to the mobile service in the frequency band 1452-1492 MHz identified for IMT is noted, pursuant to Resolution 99 (Rev. Busan, 2014) and taking into account the Israeli-Palestinian Interim Agreement of 28 September 1995.

**5.346A** The frequency band 1452-1492 MHz is identified for use by administrations in Region 3 wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-15) and Resolution 761 (WRC-15). The use of this frequency band by the above administrations for the implementation of IMT is subject to agreement obtained under No. 9.21 from countries using stations of the aeronautical mobile service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.348** The use of the band 1518-1525 MHz by the mobile-satellite service is subject to coordination under No. 9.11A. In the band 1518-1525 MHz stations in the mobile-satellite service shall not claim protection from the stations in the fixed service. No. 5.43A does not apply.

**5.348A** In the band 1518-1525 MHz, the coordination threshold in terms of the power flux-density levels at the surface of the Earth in application of No. 9.11A for space stations in the mobile-satellite (space-to-Earth) service, with respect to the land mobile service use for specialized mobile radios or used in

conjunction with public switched telecommunication networks (PSTN) operating within the territory of Japan, shall be  $-150 \text{ dB(W/m}^2\text{)}$  in any 4 kHz band for all angles of arrival, instead of those given in Table 5-2 of Appendix 5. In the band 1518-1525 MHz stations in the mobile-satellite service shall not claim protection from stations in the mobile service in the territory of Japan. No. 5.43A does not apply.

**5.348B** In the band 1518-1525 MHz, stations in the mobile-satellite service shall not claim protection from aeronautical mobile telemetry stations in the mobile service in the territory of the United States (see Nos. 5.343 and 5.344) and in the countries listed in No. 5.342. No. 5.43A does not apply.

**5.349** *Different category of service:* in Saudi Arabia, Azerbaijan, Bahrain, Cameroon, Egypt, France, Iran (Islamic Republic of), Iraq, Israel, Kazakhstan, Kuwait, The Former Yugoslav Republic of Macedonia, Lebanon, Morocco, Qatar, Syrian Arab Republic, Kyrgyzstan, Turkmenistan and Yemen, the allocation of the band 1525-1530 MHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. 5.33). (WRC-07)

**5.350** *Additional allocation:* in Azerbaijan, Kyrgyzstan and Turkmenistan, the band 1525-1530 MHz is also allocated to the aeronautical mobile service on a primary basis.

**5.351** The bands 1525-1544 MHz, 1545-1559 MHz, 1626.5-1645.5 MHz and 1646.5-1660.5 MHz shall not be used for feeder links of any service. In exceptional circumstances, however, an earth station at a specified fixed point in any of the mobile-satellite services may be authorized by an administration to communicate via space stations using these bands.

**5.351A** For the use of the bands 1518-1544 MHz, 1545-1559 MHz, 1610-1645.5 MHz, 1646.5-1660.5 MHz, 1668-1675 MHz, 1980-2010 MHz, 2170-2200 MHz, 2483.5-2520 MHz and 2670-2690 MHz by the mobile-satellite service, see Resolutions 212 (Rev.WRC-15) and 225 (Rev.WRC-12). (FCC)

**5.352A** In the frequency band 1525-1530 MHz, stations in the mobile-satellite service, except stations in the maritime mobile-satellite service, shall not cause harmful interference to, or claim protection from, stations of the fixed service in Algeria, Saudi Arabia, Egypt, France and French overseas communities of Region 3, Guinea, India, Israel, Italy, Jordan, Kuwait, Mali, Morocco, Mauritania, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syrian Arab Republic, Viet Nam and Yemen notified prior to 1 April 1998. (WRC-15)

**5.353A** In applying the procedures of Section II of Article 9 to the mobile-satellite service in the bands 1530-1544 MHz and 1626.5-1645.5 MHz, priority shall be given to accommodating the spectrum requirements for distress, urgency and safety communications of the Global Maritime Distress and Safety System (GMDSS). Maritime mobile-satellite distress, urgency and safety communications shall have priority access and immediate availability over all other mobile satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, distress, urgency and safety communications of the GMDSS. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (The provisions of Resolution 222 (Rev.WRC-12) shall apply.) (FCC)

**5.354** The use of the bands 1525-1559 MHz and 1626.5-1660.5 MHz by the mobile-satellite services is subject to coordination under No. 9.11A.

**5.355** *Additional allocation:* in Bahrain, Bangladesh, Congo (Rep. of the), Djibouti, Egypt, Eritrea, Iraq, Israel, Kuwait, Qatar, Syrian Arab Republic, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the bands 1540-1559 MHz, 1610-1645.5 MHz and 1646.5-1660 MHz are also allocated to the fixed service on a secondary basis. (WRC-12)

**5.356** The use of the band 1544-1545 MHz by the mobile-satellite service (space-to-Earth) is limited to distress and safety communications (see Article 31).

**5.357** Transmissions in the band 1545-1555 MHz from terrestrial aeronautical stations directly to aircraft stations, or between aircraft stations, in the aeronautical mobile (R) service are also authorized when such transmissions are used to extend or supplement the satellite-to-aircraft links.

**5.357A** In applying the procedures of Section II of Article 9 to the mobile-satellite service in the frequency bands 1545-1555 MHz and 1646.5-1656.5 MHz, priority shall be given to accommodating the spectrum requirements of the aeronautical mobile-satellite (R) service providing transmission of messages with priority 1 to 6 in Article 44. Aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article 44 shall have priority access and immediate availability, by pre-emption if necessary, over all other mobile-satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article 44. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (The provisions of Resolution 222 (Rev.WRC-12) shall apply.) (WRC-12)

**5.359** *Additional allocation:* in Germany, Saudi Arabia, Armenia, Azerbaijan, Belarus, Benin, Cameroon, the Russian Federation, France, Georgia, Guinea, Guinea-Bissau, Jordan, Kazakhstan, Kuwait, Lithuania, Mauritania, Uganda, Uzbekistan, Pakistan, Poland, the Syrian Arab Republic, Kyrgyzstan, the Dem. People's Rep. of Korea, Romania, Tajikistan, Tunisia, Turkmenistan and Ukraine, the frequency bands 1550-1559 MHz, 1610-1645.5 MHz and 1646.5-1660 MHz are also allocated to the fixed service on a primary basis. Administrations are urged to make all practicable efforts to avoid the implementation of new fixed-service stations in these frequency bands. (WRC-15)

**5.362A** In the United States, in the bands 1555-1559 MHz and 1656.5-1660.5 MHz, the aeronautical mobile-satellite (R) service shall have priority access and immediate availability, by pre-emption if necessary, over all other mobile-satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article 44. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services.

**5.364** The use of the band 1610-1626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to coordination under No. 9.11A. A mobile earth station operating in either of the services in this band shall not produce a peak e.i.r.p. density in excess of  $-15$  dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. 5.366 (to which No. 4.10 applies), unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, the mean e.i.r.p. density of a mobile earth station shall not exceed  $-3$  dB(W/4 kHz). Stations of the mobile-satellite service shall not claim protection from stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. 5.366 and stations in the fixed service operating in accordance with the provisions of No. 5.359. Administrations responsible for the coordination of mobile-satellite networks shall make all practicable efforts to ensure protection of stations operating in accordance with the provisions of No. 5.366.

**5.365** The use of the band 1613.8-1626.5 MHz by the mobile-satellite service (space-to-Earth) is subject to coordination under No. 9.11A.

**5.366** The band 1610-1626.5 MHz is reserved on a worldwide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based or satellite-borne facilities. Such satellite use is subject to agreement obtained under No. 9.21.

**5.367** *Additional allocation:* The frequency band 1610-1626.5 MHz is also allocated to the aeronautical mobile-satellite (R) service on a primary basis, subject to agreement obtained under No. 9.21. (WRC-12)

**5.368** With respect to the radiodetermination-satellite and mobile-satellite services the provisions of No. 4.10 do not apply in the band 1610-1626.5 MHz, with the exception of the aeronautical radionavigation-satellite service.



**5.369** *Different category of service:* in Angola, Australia, China, Eritrea, Ethiopia, India, Iran (Islamic Republic of), Israel, Lebanon, Liberia, Madagascar, Mali, Pakistan, Papua New Guinea, Syrian Arab Republic, the Dem. Rep. of the Congo, Sudan, South Sudan, Togo and Zambia, the allocation of the band 1610-1626.5 MHz to the radiodetermination-satellite service (Earth-to-space) is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21 from countries not listed in this provision. (WRC-12)

**5.370** *Different category of service:* in Venezuela, the allocation to the radiodetermination-satellite service in the band 1610-1626.5 MHz (Earth-to-space) is on a secondary basis.

**5.371** *Additional allocation:* in Region 1, the band 1610-1626.5 MHz (Earth-to-space) is also allocated to the radiodetermination-satellite service on a secondary basis, subject to agreement obtained under No. 9.21. (WRC-12)

**5.372** Harmful interference shall not be caused to stations of the radio astronomy service using the band 1610.6-1613.8 MHz by stations of the radiodetermination-satellite and mobile-satellite services (No. 29.13 applies).

**5.374** Mobile earth stations in the mobile-satellite service operating in the bands 1631.5-1634.5 MHz and 1656.5-1660 MHz shall not cause harmful interference to stations in the fixed service operating in the countries listed in No. 5.359.

**5.375** The use of the band 1645.5-1646.5 MHz by the mobile-satellite service (Earth-to-space) and for inter-satellite links is limited to distress and safety communications (see Article 31).

**5.376** Transmissions in the band 1646.5-1656.5 MHz from aircraft stations in the aeronautical mobile (R) service directly to terrestrial aeronautical stations, or between aircraft stations, are also authorized when such transmissions are used to extend or supplement the aircraft-to-satellite links.

**5.376A** Mobile earth stations operating in the band 1660-1660.5 MHz shall not cause harmful interference to stations in the radio astronomy service.

**5.379** *Additional allocation:* in Bangladesh, India, Indonesia, Nigeria and Pakistan, the band 1660.5-1668.4 MHz is also allocated to the meteorological aids service on a secondary basis.

**5.379A** Administrations are urged to give all practicable protection in the band 1660.5-1668.4 MHz for future research in radio astronomy, particularly by eliminating air-to-ground transmissions in the meteorological aids service in the band 1664.4-1668.4 MHz as soon as practicable.

**5.379B** The use of the band 1668-1675 MHz by the mobile-satellite service is subject to coordination under No. 9.11A. In the band 1668-1668.4 MHz, Resolution 904 (WRC-07) shall apply. (WRC-07)

**5.379C** In order to protect the radio astronomy service in the band 1668-1670 MHz, the aggregate power flux-density values produced by mobile earth stations in a network of the mobile-satellite service operating in this band shall not exceed  $-181$  dB(W/m<sup>2</sup>) in 10 MHz and  $-194$  dB(W/m<sup>2</sup>) in any 20 kHz at any radio astronomy station recorded in the Master International Frequency Register, for more than 2% of integration periods of 2000 s.

**5.379D** For sharing of the band 1668.4-1675 MHz between the mobile-satellite service and the fixed and mobile services, Resolution 744 (Rev.WRC-07) shall apply. (WRC-07)

**5.379E** In the band 1668.4-1675 MHz, stations in the mobile-satellite service shall not cause harmful interference to stations in the meteorological aids service in China, Iran (Islamic Republic of), Japan and Uzbekistan. In the band 1668.4-1675 MHz, administrations are urged not to implement new systems in the meteorological aids service and are encouraged to migrate existing meteorological aids service operations to other bands as soon as practicable.

**5.380A** In the band 1670-1675 MHz, stations in the mobile-satellite service shall not cause harmful interference to, nor constrain the development of, existing earth stations in the meteorological-satellite

service notified before 1 January 2004. Any new assignment to these earth stations in this band shall also be protected from harmful interference from stations in the mobile-satellite service. (WRC-07)

**5.381** *Additional allocation:* in Afghanistan, Cuba, India, Iran (Islamic Republic of) and Pakistan, the band 1690-1700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.382** *Different category of service:* in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, Congo (Rep. of the), Egypt, the United Arab Emirates, Eritrea, Ethiopia, the Russian Federation, Guinea, Iraq, Israel, Jordan, Kazakhstan, Kuwait, the Former Yugoslav Republic of Macedonia, Lebanon, Mauritania, Moldova, Mongolia, Oman, Uzbekistan, Poland, Qatar, the Syrian Arab Republic, Kyrgyzstan, Somalia, Tajikistan, Turkmenistan, Ukraine and Yemen, the allocation of the frequency band 1690-1700 MHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. 5.33), and in the Dem. People's Rep. of Korea, the allocation of the frequency band 1690-1700 MHz to the fixed service is on a primary basis (see No. 5.33) and to the mobile, except aeronautical mobile, service on a secondary basis. (WRC-15)

**5.384** *Additional allocation:* in India, Indonesia and Japan, the band 1700-1710 MHz is also allocated to the space research service (space-to-Earth) on a primary basis.

**5.384A** The frequency bands, 1710-1885 MHz, 2300-2400 MHz and 2500-2690 MHz, or portions thereof, are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-15). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.385** *Additional allocation:* the band 1718.8-1722.2 MHz is also allocated to the radio astronomy service on a secondary basis for spectral line observations.

**5.386** *Additional allocation:* the frequency band 1750-1850 MHz is also allocated to the space operation (Earth-to-space) and space research (Earth-to-space) services in Region 2 (except in Mexico), in Australia, Guam, India, Indonesia and Japan on a primary basis, subject to agreement obtained under No. 9.21, having particular regard to troposcatter systems. (WRC-15)

**5.387** *Additional allocation:* in Belarus, Georgia, Kazakhstan, Kyrgyzstan, Romania, Tajikistan and Turkmenistan, the band 1770-1790 MHz is also allocated to the meteorological-satellite service on a primary basis, subject to agreement obtained under No. 9.21. (WRC-12)

**5.388** The frequency bands 1885-2025 MHz and 2110-2200 MHz are intended for use, on a worldwide basis, by administrations wishing to implement International Mobile Telecommunications (IMT). Such use does not preclude the use of these frequency bands by other services to which they are allocated. The frequency bands should be made available for IMT in accordance with Resolution 212 (Rev.WRC-15) (see also Resolution 223 (Rev.WRC-15)). (WRC-15)

**5.388A** In Regions 1 and 3, the bands 1885-1980 MHz, 2010-2025 MHz and 2110-2170 MHz and, in Region 2, the bands 1885-1980 MHz and 2110-2160 MHz may be used by high altitude platform stations as base stations to provide International Mobile Telecommunications (IMT), in accordance with Resolution 221 (Rev.WRC-07). Their use by IMT applications using high altitude platform stations as base stations does not preclude the use of these bands by any station in the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-12)

**5.388B** In Algeria, Saudi Arabia, Bahrain, Benin, Burkina Faso, Cameroon, Comoros, Côte d'Ivoire, China, Cuba, Djibouti, Egypt, United Arab Emirates, Eritrea, Ethiopia, Gabon, Ghana, India, Iran (Islamic Republic of), Israel, Jordan, Kenya, Kuwait, Libya, Mali, Morocco, Mauritania, Nigeria, Oman, Uganda, Pakistan, Qatar, the Syrian Arab Republic, Senegal, Singapore, Sudan, South Sudan, Tanzania, Chad, Togo, Tunisia, Yemen, Zambia and Zimbabwe, for the purpose of protecting fixed and mobile services, including

IMT mobile stations, in their territories from co-channel interference, a high altitude platform station (HAPS) operating as an IMT base station in neighbouring countries, in the bands referred to in No. 5.388A, shall not exceed a co-channel power flux-density of  $-127 \text{ dB(W/(m}^2 \cdot \text{MHz))}$  at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of HAPS. (WRC-12)

**5.389A** The use of the bands 1980-2010 MHz and 2170-2200 MHz by the mobile-satellite service is subject to coordination under No. 9.11A and to the provisions of Resolution 716 (Rev.WRC-12). (FCC)

**5.389B** The use of the band 1980-1990 MHz by the mobile-satellite service shall not cause harmful interference to or constrain the development of the fixed and mobile services in Argentina, Brazil, Canada, Chile, Ecuador, the United States, Honduras, Jamaica, Mexico, Peru, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

**5.389C** The use of the bands 2010-2025 MHz and 2160-2170 MHz in Region 2 by the mobile-satellite service is subject to coordination under No. 9.11A and to the provisions of Resolution 716 (Rev.WRC-12). (FCC)

**5.389E** The use of the bands 2010-2025 MHz and 2160-2170 MHz by the mobile-satellite service in Region 2 shall not cause harmful interference to or constrain the development of the fixed and mobile services in Regions 1 and 3.

**5.389F** In Algeria, Benin, Cape Verde, Egypt, Iran (Islamic Republic of), Mali, Syrian Arab Republic and Tunisia, the use of the bands 1980-2010 MHz and 2170-2200 MHz by the mobile-satellite service shall neither cause harmful interference to the fixed and mobile services, nor hamper the development of those services prior to 1 January 2005, nor shall the former service request protection from the latter services.

**5.391** In making assignments to the mobile service in the frequency bands 2025-2110 MHz and 2200-2290 MHz, administrations shall not introduce high-density mobile systems, as described in Recommendation ITU-R SA.1154-0, and shall take that Recommendation into account for the introduction of any other type of mobile system. (WRC-15)

**5.392** Administrations are urged to take all practicable measures to ensure that space-to-space transmissions between two or more non-geostationary satellites, in the space research, space operations and Earth exploration-satellite services in the bands 2025-2110 MHz and 2200-2290 MHz, shall not impose any constraints on Earth-to-space, space-to-Earth and other space-to-space transmissions of those services and in those bands between geostationary and non-geostationary satellites.

**5.393** *Additional allocation:* in Canada, the United States and India, the frequency band 2310-2360 MHz is also allocated to the broadcasting-satellite service (sound) and complementary terrestrial sound broadcasting service on a primary basis. Such use is limited to digital audio broadcasting and is subject to the provisions of Resolution 528 (Rev.WRC-15), with the exception of *resolves* 3 in regard to the limitation on broadcasting-satellite systems in the upper 25 MHz. (WRC-15)

**5.394** In the United States, the use of the band 2300-2390 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile services. In Canada, the use of the band 2360-2400 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile services. (WRC-07)

**5.395** In France and Turkey, the use of the band 2310-2360 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service.

**5.396** Space stations of the broadcasting-satellite service in the band 2310-2360 MHz operating in accordance with No. 5.393 that may affect the services to which this band is allocated in other countries shall be coordinated and notified in accordance with Resolution 33 (Rev.WRC-15). Complementary terrestrial broadcasting stations shall be subject to bilateral coordination with neighbouring countries prior to their bringing into use. (FCC)

**5.398** In respect of the radiodetermination-satellite service in the band 2483.5-2500 MHz, the provisions of No. 4.10 do not apply.

**5.398A** *Different category of service:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine, the band 2483.5-2500 MHz is allocated on a primary basis to the radiolocation service. The radiolocation stations in these countries shall not cause harmful interference to, or claim protection from, stations of the fixed, mobile and mobile-satellite services operating in accordance with the Radio Regulations in the frequency band 2483.5-2500 MHz. (WRC-12)

**5.399** Except for cases referred to in No. 5.401, stations of the radiodetermination-satellite service operating in the frequency band 2483.5-2500 MHz for which notification information is received by the Bureau after 17 February 2012, and the service area of which includes Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine, shall not cause harmful interference to, and shall not claim protection from stations of the radiolocation service operating in these countries in accordance with No. 5.398A. (WRC-12)

**5.401** In Angola, Australia, Bangladesh, China, Eritrea, Ethiopia, India, Iran (Islamic Republic of), Lebanon, Liberia, Libya, Madagascar, Mali, Pakistan, Papua New Guinea, Syrian Arab Republic, Dem. Rep. of the Congo, Sudan, Swaziland, Togo and Zambia, the frequency band 2483.5-2500 MHz was already allocated on a primary basis to the radiodetermination-satellite service before WRC-12, subject to agreement obtained under No. 9.21 from countries not listed in this provision. Systems in the radiodetermination-satellite service for which complete coordination information has been received by the Radiocommunication Bureau before 18 February 2012 will retain their regulatory status, as of the date of receipt of the coordination request information. (WRC-15)

**5.402** The use of the band 2483.5-2500 MHz by the mobile-satellite and the radiodetermination-satellite services is subject to the coordination under No. 9.11A. Administrations are urged to take all practicable steps to prevent harmful interference to the radio astronomy service from emissions in the 2483.5-2500 MHz band, especially those caused by second-harmonic radiation that would fall into the 4990-5000 MHz band allocated to the radio astronomy service worldwide.

**5.403** Subject to agreement obtained under No. 9.21, the band 2520-2535 MHz may also be used for the mobile-satellite (space-to-Earth), except aeronautical mobile-satellite, service for operation limited to within national boundaries. The provisions of No. 9.11A apply. (WRC-07)

**5.404** *Additional allocation:* in India and Iran (Islamic Republic of), the band 2500-2516.5 MHz may also be used for the radiodetermination-satellite service (space-to-Earth) for operation limited to within national boundaries, subject to agreement obtained under No. 9.21.

**5.407** In the band 2500-2520 MHz, the power flux-density at the surface of the Earth from space stations operating in the mobile-satellite (space-to-Earth) service shall not exceed  $-152 \text{ dB (W/(m}^2 \cdot 4 \text{ kHz))}$  in Argentina, unless otherwise agreed by the administrations concerned.

**5.410** The band 2500-2690 MHz may be used for tropospheric scatter systems in Region 1, subject to agreement obtained under No. 9.21. No. 9.21 does not apply to tropospheric scatter links situated entirely outside Region 1. Administrations shall make all practicable efforts to avoid developing new tropospheric scatter systems in this band. When planning new tropospheric scatter radio-relay links in this band, all possible measures shall be taken to avoid directing the antennas of these links towards the geostationary-satellite orbit. (WRC-12)

**5.412** *Alternative allocation:* in Kyrgyzstan and Turkmenistan, the band 2500-2690 MHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

**5.413** In the design of systems in the broadcasting-satellite service in the bands between 2500 MHz and 2690 MHz, administrations are urged to take all necessary steps to protect the radio astronomy service in the band 2690-2700 MHz.

**5.414** The allocation of the frequency band 2500-2520 MHz to the mobile-satellite service (space-to-Earth) is subject to coordination under No. 9.11A. (WRC-07)

**5.414A** In Japan and India, the use of the bands 2500-2520 MHz and 2520-2535 MHz, under No. 5.403, by a satellite network in the mobile-satellite service (space-to-Earth) is limited to operation within national boundaries and subject to the application of No. 9.11A. The following pfd values shall be used as a threshold for coordination under No. 9.11A, for all conditions and for all methods of modulation, in an area of 1000 km around the territory of the administration notifying the mobile-satellite service network:

–136 dB(W/(m<sup>2</sup> · MHz)) for  $0^\circ \leq \theta \leq 5^\circ$

–136 + 0.55 (θ – 5) dB(W/(m<sup>2</sup> · MHz)) for  $5^\circ < \theta \leq 25^\circ$

–125 dB(W/(m<sup>2</sup> · MHz)) for  $25^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees. Outside this area Table 21-4 of Article 21 shall apply. Furthermore, the coordination thresholds in Table 5-2 of Annex 1 to Appendix 5 of the Radio Regulations (Edition of 2004), in conjunction with the applicable provisions of Articles 9 and 11 associated with No. 9.11A, shall apply to systems for which complete notification information has been received by the Radiocommunication Bureau by 14 November 2007 and that have been brought into use by that date. (WRC-07)

**5.415** The use of the bands 2500-2690 MHz in Region 2 and 2500-2535 MHz and 2655-2690 MHz in Region 3 by the fixed-satellite service is limited to national and regional systems, subject to agreement obtained under No. 9.21, giving particular attention to the broadcasting-satellite service in Region 1. (WRC-07)

**5.415A** *Additional allocation:* in India and Japan, subject to agreement obtained under No. 9.21, the band 2515-2535 MHz may also be used for the aeronautical mobile-satellite service (space-to-Earth) for operation limited to within their national boundaries.

**5.416** The use of the band 2520-2670 MHz by the broadcasting-satellite service is limited to national and regional systems for community reception, subject to agreement obtained under No. 9.21. The provisions of No. 9.19 shall be applied by administrations in this band in their bilateral and multilateral negotiations. (WRC-07)

**5.418** *Additional allocation:* in India, the frequency band 2535-2655 MHz is also allocated to the broadcasting-satellite service (sound) and complementary terrestrial broadcasting service on a primary basis. Such use is limited to digital audio broadcasting and is subject to the provisions of Resolution 528 (Rev.WRC-15). The provisions of No. 5.416 and Table 21-4 of Article 21, do not apply to this additional allocation. Use of non-geostationary-satellite systems in the broadcasting-satellite service (sound) is subject to Resolution 539 (Rev.WRC-15). Geostationary broadcasting-satellite service (sound) systems for which complete Appendix 4 coordination information has been received after 1 June 2005 are limited to systems intended for national coverage. The power flux-density at the Earth's surface produced by emissions from a geostationary broadcasting-satellite service (sound) space station operating in the frequency band 2630-2655 MHz, and for which complete Appendix 4 coordination information has been received after 1 June 2005, shall not exceed the following limits, for all conditions and for all methods of modulation:

–130 dB(W/(m<sup>2</sup> · MHz)) for  $0^\circ \leq \theta \leq 5^\circ$

–130 + 0.4 (θ – 5) dB(W/(m<sup>2</sup> · MHz)) for  $5^\circ < \theta \leq 25^\circ$

–122 dB(W/(m<sup>2</sup> · MHz)) for  $25^\circ < \theta \leq 90^\circ$

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees. These limits may be exceeded on the territory of any country whose administration has so agreed. As an exception to the limits above, the pfd value of –122 dB(W/(m<sup>2</sup> · MHz)) shall be used as a threshold for coordination under No. 9.11 in an area of 1500 km around the territory of the administration notifying the broadcasting-satellite service (sound) system.

In addition, an administration listed in this provision shall not have simultaneously two overlapping frequency assignments, one under this provision and the other under No. 5.416 for systems for which complete Appendix 4 coordination information has been received after 1 June 2005. (WRC-15)

**5.418A** In certain Region 3 countries listed in No. 5.418, use of the band 2630-2655 MHz by non-geostationary-satellite systems in the broadcasting-satellite service (sound) for which complete Appendix 4 coordination information, or notification information, has been received after 2 June 2000, is subject to the application of the provisions of No. 9.12A, in respect of geostationary-satellite networks for which complete Appendix 4 coordination information, or notification information, is considered to have been received after 2 June 2000, and No. 22.2 does not apply. No. 22.2 shall continue to apply with respect to geostationary-satellite networks for which complete Appendix 4 coordination information, or notification information, is considered to have been received before 3 June 2000.

**5.418B** Use of the band 2630-2655 MHz by non-geostationary-satellite systems in the broadcasting-satellite service (sound), pursuant to No. 5.418, for which complete Appendix 4 coordination information, or notification information, has been received after 2 June 2000, is subject to the application of the provisions of No. 9.12.

**5.418C** Use of the band 2630-2655 MHz by geostationary-satellite networks for which complete Appendix 4 coordination information, or notification information, has been received after 2 June 2000 is subject to the application of the provisions of No. 9.13 with respect to non-geostationary-satellite systems in the broadcasting-satellite service (sound), pursuant to No. 5.418 and No. 22.2 does not apply.

**5.419** When introducing systems of the mobile-satellite service in the band 2670-2690 MHz, administrations shall take all necessary steps to protect the satellite systems operating in this band prior to 3 March 1992. The coordination of mobile-satellite systems in the band shall be in accordance with No. 9.11A. (WRC-07)

**5.420** The band 2655-2670 MHz may also be used for the mobile-satellite (Earth-to-space), except aeronautical mobile-satellite, service for operation limited to within national boundaries, subject to agreement obtained under No. 9.21. The coordination under No. 9.11A applies. (WRC-07)

**5.422** *Additional allocation:* in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, Brunei Darussalam, Congo (Rep. of the), Côte d'Ivoire, Cuba, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Gabon, Georgia, Guinea, Guinea-Bissau, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Mauritania, Mongolia, Montenegro, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syrian Arab Republic, Kyrgyzstan, the Dem. Rep. of the Congo, Romania, Somalia, Tajikistan, Tunisia, Turkmenistan, Ukraine and Yemen, the band 2690-2700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. Such use is limited to equipment in operation by 1 January 1985. (WRC-12)

**5.423** In the band 2700-2900 MHz, ground-based radars used for meteorological purposes are authorized to operate on a basis of equality with stations of the aeronautical radionavigation service.

**5.424** *Additional allocation:* in Canada, the band 2850-2900 MHz is also allocated to the maritime radionavigation service, on a primary basis, for use by shore-based radars.

**5.424A** In the band 2900-3100 MHz, stations in the radiolocation service shall not cause harmful interference to, nor claim protection from, radar systems in the radionavigation service.

**5.425** In the band 2900-3100 MHz, the use of the shipborne interrogator-transponder (SIT) system shall be confined to the sub-band 2930-2950 MHz.

**5.426** The use of the band 2900-3100 MHz by the aeronautical radionavigation service is limited to ground-based radars.

**5.427** In the bands 2900-3100 MHz and 9300-9500 MHz, the response from radar transponders shall not be capable of being confused with the response from radar beacons (racons) and shall not cause interference to ship or aeronautical radars in the radionavigation service, having regard, however, to No. 4.9.

**5.428** *Additional allocation:* in Azerbaijan, Kyrgyzstan and Turkmenistan, the frequency band 3100-3300 MHz is also allocated to the radionavigation service on a primary basis. (WRC-15)

**5.429** *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Benin, Brunei Darussalam, Cambodia, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Egypt, the United Arab Emirates, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kenya, Kuwait, Lebanon, Libya, Malaysia, Oman, Uganda, Pakistan, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, the Dem. People's Rep. of Korea, Sudan and Yemen, the frequency band 3300-3400 MHz is also allocated to the fixed and mobile services on a primary basis. The countries bordering the Mediterranean shall not claim protection for their fixed and mobile services from the radiolocation service. (WRC-15)

**5.429A** *Additional allocation:* in Angola, Benin, Botswana, Burkina Faso, Burundi, Ghana, Guinea, Guinea-Bissau, Lesotho, Liberia, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sudan, South Sudan, South Africa, Swaziland, Tanzania, Chad, Togo, Zambia and Zimbabwe, the frequency band 3300-3400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis. Stations in the mobile service operating in the frequency band 3300-3400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-15)

**5.429B** In the following countries of Region 1 south of 30° parallel north: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Congo (Rep. of the), Côte d'Ivoire, Egypt, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mauritania, Mozambique, Namibia, Niger, Nigeria, Uganda, the Dem. Rep. of the Congo, Rwanda, Sudan, South Sudan, South Africa, Swaziland, Tanzania, Chad, Togo, Zambia and Zimbabwe, the frequency band 3300-3400 MHz is identified for the implementation of International Mobile Telecommunications (IMT). The use of this frequency band shall be in accordance with Resolution 223 (Rev.WRC-15). The use of the frequency band 3300-3400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, and administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.429C** *Different category of service:* in Argentina, Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Paraguay and Uruguay, the frequency band 3300-3400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis. In Argentina, Brazil, Guatemala, Mexico and Paraguay, the frequency band 3300-3400 MHz is also allocated to the fixed service on a primary basis. Stations in the fixed and mobile services operating in the frequency band 3300-3400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-15)

**5.429D** In the following countries in Region 2: Argentina, Colombia, Costa Rica, Ecuador, Mexico and Uruguay, the use of the frequency band 3300-3400 MHz is identified for the implementation of International Mobile Telecommunications (IMT). Such use shall be in accordance with Resolution 223 (Rev.WRC-15). This use in Argentina and Uruguay is subject to the application of No. 9.21. The use of the frequency band 3300-3400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, and administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.429E** *Additional allocation:* in Papua New Guinea, the frequency band 3300-3400 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis. Stations in the mobile service operating in the frequency band 3300-3400 MHz shall not cause harmful interference to, or claim protection from, stations operating in the radiolocation service. (WRC-15)

**5.429F** In the following countries in Region 3: Cambodia, India, Lao P.D.R., Pakistan, the Philippines and Viet Nam, the use of the frequency band 3300-3400 MHz is identified for the implementation of International Mobile Telecommunications (IMT). Such use shall be in accordance with Resolution 223 (Rev.WRC-15). The use of the frequency band 3300-3400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service. Before an administration brings into use a base or mobile station of an IMT system in this frequency band, it shall seek agreement under No. 9.21 with neighbouring countries to protect the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-15)

**5.430** *Additional allocation:* in Azerbaijan, Kyrgyzstan and Turkmenistan, the frequency band 3300-3400 MHz is also allocated to the radionavigation service on a primary basis. (WRC-15)

**5.430A** The allocation of the frequency band 3400-3600 MHz to the mobile, except aeronautical mobile, service is subject to agreement obtained under No. 9.21. This frequency band is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The provisions of Nos. 9.17 and 9.18 shall also apply in the coordination phase. Before an administration brings into use a (base or mobile) station of the mobile service in this frequency band, it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) and with the assistance of the Bureau if so requested. In case of disagreement, calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band 3400-3600 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). This allocation is effective from 17 November 2010. (WRC-15)

**5.431** *Additional allocation:* in Germany and Israel, the frequency band 3400-3475 MHz is also allocated to the amateur service on a secondary basis. (WRC-15)

**5.431A** In Region 2, the allocation of the frequency band 3400-3500 MHz to the mobile, except aeronautical mobile, service on a primary basis is subject to agreement obtained under No. 9.21. (WRC-15)

**5.431B** In Region 2, the frequency band 3400-3600 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a base or mobile station of an IMT system, it shall seek agreement under No. 9.21 with other administrations and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the



administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service, including IMT systems, in the frequency band 3400-3600 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). (WRC-15)

**5.432** *Different category of service:* in Korea (Rep. of), Japan and Pakistan, the allocation of the band 3400-3500 MHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. 5.33).

**5.432A** In Korea (Rep. of), Japan and Pakistan, the band 3400-3500 MHz is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the band 3400-3500 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). (WRC-07)

**5.432B** *Different category of service:* in Australia, Bangladesh, China, French overseas communities of Region 3, India, Iran (Islamic Republic of), New Zealand, the Philippines and Singapore, the frequency band 3400-3500 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement obtained under No. 9.21 with other administrations and is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this frequency band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band 3400-3500 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). (WRC-15)

**5.433** In Regions 2 and 3, in the band 3400-3600 MHz the radiolocation service is allocated on a primary basis. However, all administrations operating radiolocation systems in this band are urged to cease operations by 1985. Thereafter, administrations shall take all practicable steps to protect the fixed-satellite service and coordination requirements shall not be imposed on the fixed-satellite service.

**5.433A** In Australia, Bangladesh, China, French overseas communities of Region 3, Korea (Rep. of), India, Iran (Islamic Republic of), Japan, New Zealand, Pakistan and the Philippines, the frequency band 3500-

3600 MHz is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this frequency band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB (W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the frequency band 3500-3600 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). (WRC-15)

**5.434** In Canada, Colombia, Costa Rica and the United States, the frequency band 3600-3700 MHz, or portions thereof, is identified for use by these administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a base or mobile station of an IMT system, it shall seek agreement under No. 9.21 with other administrations and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service, including IMT systems, in the frequency band 3600-3700 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). (WRC-15)

**5.435** In Japan, in the band 3620-3700 MHz, the radiolocation service is excluded.

**5.436** Use of the frequency band 4200-4400 MHz by stations in the aeronautical mobile (R) service is reserved exclusively for wireless avionics intra-communication systems that operate in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution 424 (WRC-15). (WRC-15)

**5.437** Passive sensing in the Earth exploration-satellite and space research services may be authorized in the frequency band 4200-4400 MHz on a secondary basis. (WRC-15)

**5.438** Use of the frequency band 4200-4400 MHz by the aeronautical radionavigation service is reserved exclusively for radio altimeters installed on board aircraft and for the associated transponders on the ground. (WRC-15)

**5.439** *Additional allocation:* in Iran (Islamic Republic of), the band 4200-4400 MHz is also allocated to the fixed service on a secondary basis. (WRC-12)

**5.440** The standard frequency and time signal-satellite service may be authorized to use the frequency 4202 MHz for space-to-Earth transmissions and the frequency 6427 MHz for Earth-to-space transmissions. Such

transmissions shall be confined within the limits of  $\pm 2$  MHz of these frequencies, subject to agreement obtained under No. 9.21.

**5.440A** In Region 2 (except Brazil, Cuba, French overseas departments and communities, Guatemala, Paraguay, Uruguay and Venezuela), and in Australia, the band 4400-4940 MHz may be used for aeronautical mobile telemetry for flight testing by aircraft stations (see No. 1.83). Such use shall be in accordance with Resolution 416 (WRC-07) and shall not cause harmful interference to, nor claim protection from, the fixed-satellite and fixed services. Any such use does not preclude the use of this band by other mobile service applications or by other services to which this band is allocated on a co-primary basis and does not establish priority in the Radio Regulations. (WRC-07)

**5.441** The use of the bands 4500-4800 MHz (space-to-Earth), 6725-7025 MHz (Earth-to-space) by the fixed-satellite service shall be in accordance with the provisions of Appendix 30B. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary-satellite systems in the fixed-satellite service shall be in accordance with the provisions of Appendix 30B. The use of the bands 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by a non-geostationary-satellite system in the fixed-satellite service is subject to application of the provisions of No. 9.12 for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite networks, and No. 5.43A does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the above bands shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.

**5.441A** In Uruguay, the frequency band 4800-4900 MHz, or portions thereof, is identified for the implementation of International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of this frequency band for the implementation of IMT is subject to agreement obtained with neighbouring countries, and IMT stations shall not claim protection from stations of other applications of the mobile service. Such use shall be in accordance with Resolution 223 (Rev.WRC-15). (WRC-15)

**5.441B** In Cambodia, Lao P.D.R. and Viet Nam, the frequency band 4800-4990 MHz, or portions thereof, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. The use of this frequency band for the implementation of IMT is subject to agreement obtained under No. 9.21 with concerned administrations, and IMT stations shall not claim protection from stations of other applications of the mobile service. In addition, before an administration brings into use an IMT station in the mobile service, it shall ensure that the power flux-density produced by this station does not exceed  $-155 \text{ dB(W/(m}^2 \cdot 1 \text{ MHz))}$  produced up to 19 km above sea level at 20 km from the coast, defined as the low-water mark, as officially recognized by the coastal State. This criterion is subject to review at WRC-19. See Resolution 223 (Rev.WRC-15). This identification shall be effective after WRC-19. (WRC-15)

**5.442** In the frequency bands 4825-4835 MHz and 4950-4990 MHz, the allocation to the mobile service is restricted to the mobile, except aeronautical mobile, service. In Region 2 (except Brazil, Cuba, Guatemala, Mexico, Paraguay, Uruguay and Venezuela), and in Australia, the frequency band 4825-4835 MHz is also allocated to the aeronautical mobile service, limited to aeronautical mobile telemetry for

flight testing by aircraft stations. Such use shall be in accordance with Resolution 416 (WRC-07) and shall not cause harmful interference to the fixed service. (WRC-15)

**5.443** *Different category of service:* in Argentina, Australia and Canada, the allocation of the bands 4825-4835 MHz and 4950-4990 MHz to the radio astronomy service is on a primary basis (see No. 5.33).

**5.443AA** In the frequency bands 5000-5030 MHz and 5091-5150 MHz, the aeronautical mobile-satellite (R) service is subject to agreement obtained under No. 9.21. The use of these bands by the aeronautical mobile-satellite (R) service is limited to internationally standardized aeronautical systems. (WRC-12)

**5.443B** In order not to cause harmful interference to the microwave landing system operating above 5030 MHz, the aggregate power flux-density produced at the Earth's surface in the frequency band 5030-5150 MHz by all the space stations within any radionavigation-satellite service system (space-to-Earth) operating in the frequency band 5010-5030 MHz shall not exceed  $-124.5$  dB(W/m<sup>2</sup>) in a 150 kHz band. In order not to cause harmful interference to the radio astronomy service in the frequency band 4990-5000 MHz, radionavigation-satellite service systems operating in the frequency band 5010-5030 MHz shall comply with the limits in the frequency band 4990-5000 MHz defined in Resolution 741 (Rev.WRC-15). (WRC-15)

**5.443C** The use of the frequency band 5030-5091 MHz by the aeronautical mobile (R) service is limited to internationally standardized aeronautical systems. Unwanted emissions from the aeronautical mobile (R) service in the frequency band 5030-5091 MHz shall be limited to protect RNSS system downlinks in the adjacent 5010-5030 MHz band. Until such time that an appropriate value is established in a relevant ITU-R Recommendation, the e.i.r.p. density limit of  $-75$  dBW/MHz in the frequency band 5010-5030 MHz for any AM(R)S station unwanted emission should be used. (WRC-12)

**5.443D** In the frequency band 5030-5091 MHz, the aeronautical mobile-satellite (R) service is subject to coordination under No. 9.11A. The use of this frequency band by the aeronautical mobile-satellite (R) service is limited to internationally standardized aeronautical systems. (WRC-12)

**5.444** The frequency band 5030-5150 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. In the frequency band 5030-5091 MHz, the requirements of this system shall have priority over other uses of this frequency band. For the use of the frequency band 5091-5150 MHz, No. 5.444A and Resolution 114 (Rev.WRC-15) apply. (WRC-15)

**5.444A** The use of the allocation to the fixed-satellite service (Earth-to-space) in the frequency band 5091-5150 MHz is limited to feeder links of non-geostationary satellite systems in the mobile-satellite service and is subject to coordination under No. 9.11A. The use of the frequency band 5091-5150 MHz by feeder links of non-geostationary satellite systems in the mobile-satellite service shall be subject to application of Resolution 114 (Rev.WRC-15). Moreover, to ensure that the aeronautical radionavigation service is protected from harmful interference, coordination is required for feeder-link earth stations of the non-geostationary satellite systems in the mobile-satellite service which are separated by less than 450 km from the territory of an administration operating ground stations in the aeronautical radionavigation service. (WRC-15)

**5.444B** The use of the frequency band 5091-5150 MHz by the aeronautical mobile service is limited to:

- systems operating in the aeronautical mobile (R) service and in accordance with international aeronautical standards, limited to surface applications at airports. Such use shall be in accordance with Resolution 748 (Rev.WRC-15);
- aeronautical telemetry transmissions from aircraft stations (see No. 1.83) in accordance with Resolution 418 (Rev.WRC-15). (WRC-15)

**5.446** *Additional allocation:* in the countries listed in No. 5.369, the frequency band 5150-5216 MHz is also allocated to the radiodetermination-satellite service (space-to-Earth) on a primary basis, subject to

agreement obtained under No. 9.21. In Region 2 (except in Mexico), the frequency band is also allocated to the radiodetermination-satellite service (space-to-Earth) on a primary basis. In Regions 1 and 3, except those countries listed in No. 5.369 and Bangladesh, the frequency band is also allocated to the radiodetermination-satellite service (space-to-Earth) on a secondary basis. The use by the radiodetermination-satellite service is limited to feeder links in conjunction with the radiodetermination-satellite service operating in the frequency bands 1610-1626.5 MHz and/or 2483.5-2500 MHz. The total power flux-density at the Earth's surface shall in no case exceed  $-159$  dB (W/m<sup>2</sup>) in any 4 kHz band for all angles of arrival. (WRC-15)

**5.446A** The use of the bands 5150-5350 MHz and 5470-5725 MHz by the stations in the mobile, except aeronautical mobile, service shall be in accordance with Resolution 229 (Rev.WRC-12). (WRC-12)

**5.446B** In the band 5150-5250 MHz, stations in the mobile service shall not claim protection from earth stations in the fixed-satellite service. No. 5.43A does not apply to the mobile service with respect to fixed-satellite service earth stations.

**5.446C** *Additional allocation:* in Region 1 (except in Algeria, Saudi Arabia, Bahrain, Egypt, United Arab Emirates, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Syrian Arab Republic, Sudan, South Sudan and Tunisia) and in Brazil, the band 5150-5250 MHz is also allocated to the aeronautical mobile service on a primary basis, limited to aeronautical telemetry transmissions from aircraft stations (see No. 1.83), in accordance with Resolution 418 (Rev.WRC-15). These stations shall not claim protection from other stations operating in accordance with Article 5. No. 5.43A does not apply. (FCC)

**5.447** *Additional allocation:* in Côte d'Ivoire, Egypt, Israel, Lebanon, the Syrian Arab Republic and Tunisia, the band 5150-5250 MHz is also allocated to the mobile service, on a primary basis, subject to agreement obtained under No. 9.21. In this case, the provisions of Resolution 229 (Rev.WRC-12) do not apply. (WRC-12)

**5.447A** The allocation to the fixed-satellite service (Earth-to-space) in the band 5150-5250 MHz is limited to feeder links of non-geostationary-satellite systems in the mobile-satellite service and is subject to coordination under No. 9.11A.

**5.447B** *Additional allocation:* the band 5150-5216 MHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis. This allocation is limited to feeder links of non-geostationary-satellite systems in the mobile-satellite service and is subject to provisions of No. 9.11A. The power flux-density at the Earth's surface produced by space stations of the fixed-satellite service operating in the space-to-Earth direction in the band 5150-5216 MHz shall in no case exceed  $-164$  dB(W/m<sup>2</sup>) in any 4 kHz band for all angles of arrival.

**5.447C** Administrations responsible for fixed-satellite service networks in the band 5150-5250 MHz operated under Nos. 5.447A and 5.447B shall coordinate on an equal basis in accordance with No. 9.11A with administrations responsible for non-geostationary-satellite networks operated under No. 5.446 and brought into use prior to 17 November 1995. Satellite networks operated under No. 5.446 brought into use after 17 November 1995 shall not claim protection from, and shall not cause harmful interference to, stations of the fixed-satellite service operated under Nos. 5.447A and 5.447B.

**5.447D** The allocation of the band 5250-5255 MHz to the space research service on a primary basis is limited to active spaceborne sensors. Other uses of the band by the space research service are on a secondary basis.

**5.447E** *Additional allocation:* The frequency band 5250-5350 MHz is also allocated to the fixed service on a primary basis in the following countries in Region 3: Australia, Korea (Rep. of), India, Indonesia, Iran (Islamic Republic of), Japan, Malaysia, Papua New Guinea, the Philippines, Dem. People's Rep. of Korea, Sri Lanka, Thailand and Viet Nam. The use of this frequency band by the fixed service is intended for the implementation of fixed wireless access systems and shall comply with Recommendation ITU-R F.1613-0.

In addition, the fixed service shall not claim protection from the radiodetermination, Earth exploration-satellite (active) and space research (active) services, but the provisions of No. 5.43A do not apply to the fixed service with respect to the Earth exploration-satellite (active) and space research (active) services. After implementation of fixed wireless access systems in the fixed service with protection for the existing radiodetermination systems, no more stringent constraints should be imposed on the fixed wireless access systems by future radiodetermination implementations. (WRC-15)

**5.447F** In the frequency band 5250-5350 MHz, stations in the mobile service shall not claim protection from the radiolocation service, the Earth exploration-satellite service (active) and the space research service (active). These services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendations ITU-R M.1638-0 and ITU-R RS.1632-0. (WRC-15)

**5.448** *Additional allocation:* in Azerbaijan, Kyrgyzstan, Romania and Turkmenistan, the band 5250-5350 MHz is also allocated to the radionavigation service on a primary basis. (WRC-12)

**5.448A** The Earth exploration-satellite (active) and space research (active) services in the frequency band 5250-5350 MHz shall not claim protection from the radiolocation service. No. 5.43A does not apply.

**5.448B** The Earth exploration-satellite service (active) operating in the band 5350-5570 MHz and space research service (active) operating in the band 5460-5570 MHz shall not cause harmful interference to the aeronautical radionavigation service in the band 5350-5460 MHz, the radionavigation service in the band 5460-5470 MHz and the maritime radionavigation service in the band 5470-5570 MHz.

**5.448C** The space research service (active) operating in the band 5350-5460 MHz shall not cause harmful interference to nor claim protection from other services to which this band is allocated.

**5.448D** In the frequency band 5350-5470 MHz, stations in the radiolocation service shall not cause harmful interference to, nor claim protection from, radar systems in the aeronautical radionavigation service operating in accordance with No. 5.449.

**5.449** The use of the band 5350-5470 MHz by the aeronautical radionavigation service is limited to airborne radars and associated airborne beacons.

**5.450** *Additional allocation:* in Austria, Azerbaijan, Iran (Islamic Republic of), Kyrgyzstan, Romania, Turkmenistan and Ukraine, the band 5470-5650 MHz is also allocated to the aeronautical radionavigation service on a primary basis. (WRC-12)

**5.450A** In the frequency band 5470-5725 MHz, stations in the mobile service shall not claim protection from radiodetermination services. Radiodetermination services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendation ITU-R M.1638-0. (WRC-15)

**5.450B** In the frequency band 5470-5650 MHz, stations in the radiolocation service, except ground-based radars used for meteorological purposes in the band 5600-5650 MHz, shall not cause harmful interference to, nor claim protection from, radar systems in the maritime radionavigation service.

**5.451** *Additional allocation:* in the United Kingdom, the band 5470-5850 MHz is also allocated to the land mobile service on a secondary basis. The power limits specified in Nos. 21.2, 21.3, 21.4 and 21.5 shall apply in the band 5725-5850 MHz.

**5.452** Between 5600 MHz and 5650 MHz, ground-based radars used for meteorological purposes are authorized to operate on a basis of equality with stations of the maritime radionavigation service.

**5.453** *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Djibouti, Egypt, the United Arab Emirates, Gabon, Guinea, Equatorial Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kenya, Kuwait, Lebanon, Libya, Madagascar, Malaysia, Niger, Nigeria, Oman, Uganda, Pakistan, the

Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Sri Lanka, Swaziland, Tanzania, Chad, Thailand, Togo, Viet Nam and Yemen, the band 5650-5850 MHz is also allocated to the fixed and mobile services on a primary basis. In this case, the provisions of Resolution 229 (Rev.WRC-12) do not apply. (WRC-12)

**5.454** *Different category of service:* in Azerbaijan, the Russian Federation, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 5670-5725 MHz to the space research service is on a primary basis (see No. 5.33). (WRC-12)

**5.455** *Additional allocation:* in Armenia, Azerbaijan, Belarus, Cuba, the Russian Federation, Georgia, Hungary, Kazakhstan, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 5670-5850 MHz is also allocated to the fixed service on a primary basis. (WRC-07)

**5.457** In Australia, Burkina Faso, Cote d'Ivoire, Mali and Nigeria, the allocation to the fixed service in the bands 6440-6520 MHz (HAPS-to-ground direction) and 6560-6640 MHz (ground-to-HAPS direction) may also be used by gateway links for high-altitude platform stations (HAPS) within the territory of these countries. Such use is limited to operation in HAPS gateway links and shall not cause harmful interference to, and shall not claim protection from, existing services, and shall be in compliance with Resolution 150 (WRC-12). Existing services shall not be constrained in future development by HAPS gateway links. The use of HAPS gateway links in these bands requires explicit agreement with other administrations whose territories are located within 1000 kilometres from the border of an administration intending to use the HAPS gateway links. (WRC-12)

**5.457A** In the frequency bands 5925-6425 MHz and 14-14.5 GHz, earth stations located on board vessels may communicate with space stations of the fixed-satellite service. Such use shall be in accordance with Resolution 902 (WRC-03). In the frequency band 5925-6425 MHz, earth stations located on board vessels and communicating with space stations of the fixed-satellite service may employ transmit antennas with minimum diameter of 1.2 m and operate without prior agreement of any administration if located at least 330 km away from the low-water mark as officially recognized by the coastal State. All other provisions of Resolution 902 (WRC-03) shall apply. (WRC-15)

**5.457B** In the frequency bands 5925-6425 MHz and 14-14.5 GHz, earth stations located on board vessels may operate with the characteristics and under the conditions contained in Resolution 902 (WRC-03) in Algeria, Saudi Arabia, Bahrain, Comoros, Djibouti, Egypt, United Arab Emirates, Jordan, Kuwait, Libya, Morocco, Mauritania, Oman, Qatar, the Syrian Arab Republic, Sudan, Tunisia and Yemen, in the maritime mobile-satellite service on a secondary basis. Such use shall be in accordance with Resolution 902 (WRC-03). (WRC-15)

**5.457C** In Region 2 (except Brazil, Cuba, French overseas departments and communities, Guatemala, Mexico, Paraguay, Uruguay and Venezuela), the frequency band 5925-6700 MHz may be used for aeronautical mobile telemetry for flight testing by aircraft stations (see No. 1.83). Such use shall be in accordance with Resolution 416 (WRC-07) and shall not cause harmful interference to, or claim protection from, the fixed-satellite and fixed services. Any such use does not preclude the use of this frequency band by other mobile service applications or by other services to which this frequency band is allocated on a co-primary basis and does not establish priority in the Radio Regulations. (WRC-15)

**5.458** In the band 6425-7075 MHz, passive microwave sensor measurements are carried out over the oceans. In the band 7075-7250 MHz, passive microwave sensor measurements are carried out. Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6425-7075 MHz and 7075-7250 MHz.

**5.458A** In making assignments in the band 6700-7075 MHz to space stations of the fixed-satellite service, administrations are urged to take all practicable steps to protect spectral line observations of the radio astronomy service in the band 6650-6675.2 MHz from harmful interference from unwanted emissions.

**5.458B** The space-to-Earth allocation to the fixed-satellite service in the band 6700-7075 MHz is limited to feeder links for non-geostationary satellite systems of the mobile-satellite service and is subject to coordination under No. 9.11A. The use of the band 6700-7075 MHz (space-to-Earth) by feeder links for non-geostationary satellite systems in the mobile-satellite service is not subject to No. 22.2.

**5.459** *Additional allocation:* in the Russian Federation, the frequency bands 7100-7155 MHz and 7190-7235 MHz are also allocated to the space operation service (Earth-to-space) on a primary basis, subject to agreement obtained under No. 9.21. In the frequency band 7190-7235 MHz, with respect to the Earth exploration-satellite service (Earth-to-space), No. 9.21 does not apply. (WRC-15)

**5.460** No emissions from space research service (Earth-to-space) systems intended for deep space shall be effected in the frequency band 7190-7235 MHz. Geostationary satellites in the space research service operating in the frequency band 7190-7235 MHz shall not claim protection from existing and future stations of the fixed and mobile services and No. 5.43A does not apply. (WRC-15)

**5.460A** The use of the frequency band 7190-7250 MHz (Earth-to-space) by the Earth exploration-satellite service shall be limited to tracking, telemetry and command for the operation of spacecraft. Space stations operating in the Earth exploration-satellite service (Earth-to-space) in the frequency band 7190-7250 MHz shall not claim protection from existing and future stations in the fixed and mobile services, and No. 5.43A does not apply. No. 9.17 applies. Additionally, to ensure protection of the existing and future deployment of fixed and mobile services, the location of earth stations supporting spacecraft in the Earth exploration-satellite service in non-geostationary orbits or geostationary orbit shall maintain a separation distance of at least 10 km and 50 km, respectively, from the respective border(s) of neighbouring countries, unless a shorter distance is otherwise agreed between the corresponding administrations. (WRC-15)

**5.460B** Space stations on the geostationary orbit operating in the Earth exploration-satellite service (Earth-to-space) in the frequency band 7190-7235 MHz shall not claim protection from existing and future stations of the space research service, and No. 5.43A does not apply. (WRC-15)

**5.461** *Additional allocation:* the bands 7250-7375 MHz (space-to-Earth) and 7900-8025 MHz (Earth-to-space) are also allocated to the mobile-satellite service on a primary basis, subject to agreement obtained under No. 9.21.

**5.461A** The use of the band 7450-7550 MHz by the meteorological-satellite service (space-to-Earth) is limited to geostationary-satellite systems. Non-geostationary meteorological-satellite systems in this band notified before 30 November 1997 may continue to operate on a primary basis until the end of their lifetime.

**5.461AA** The use of the frequency band 7375-7750 MHz by the maritime mobile-satellite service is limited to geostationary-satellite networks. (WRC-15)

**5.461AB** In the frequency band 7375-7750 MHz, earth stations in the maritime mobile-satellite service shall not claim protection from, nor constrain the use and development of, stations in the fixed and mobile, except aeronautical mobile, services. No. 5.43A does not apply. (WRC-15)

**5.461B** The use of the band 7750-7900 MHz by the meteorological-satellite service (space-to-Earth) is limited to non-geostationary satellite systems. (WRC-12)

**5.462A** In Regions 1 and 3 (except for Japan), in the band 8025-8400 MHz, the Earth exploration-satellite service using geostationary satellites shall not produce a power flux-density in excess of the following values for angles of arrival ( $\theta$ ), without the consent of the affected administration:

- 135 dB(W/m<sup>2</sup>) in a 1 MHz band for  $0 \leq \theta < 5^\circ$
- 135 + 0.5 ( $\theta - 5$ ) dB(W/m<sup>2</sup>) in a 1 MHz band for  $5 \leq \theta < 25^\circ$
- 125 dB(W/m<sup>2</sup>) in a 1 MHz band for  $25 \leq \theta \leq 90^\circ$  (WRC-12)

**5.463** Aircraft stations are not permitted to transmit in the band 8025-8400 MHz.

**5.465** In the space research service, the use of the band 8400-8450 MHz is limited to deep space.



**5.466** *Different category of service:* in Singapore and Sri Lanka, the allocation of the band 8400-8500 MHz to the space research service is on a secondary basis (see No. 5.32). (WRC-12)

**5.468** *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Burundi, Cameroon, China, Congo (Rep. of the), Djibouti, Egypt, the United Arab Emirates, Gabon, Guyana, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Jordan, Kenya, Kuwait, Lebanon, Libya, Malaysia, Mali, Morocco, Mauritania, Nepal, Nigeria, Oman, Uganda, Pakistan, Qatar, Syrian Arab Republic, the Dem. People's Rep. of Korea, Senegal, Singapore, Somalia, Sudan, Swaziland, Chad, Togo, Tunisia and Yemen, the frequency band 8500-8750 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-15)

**5.469** *Additional allocation:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Hungary, Lithuania, Mongolia, Uzbekistan, Poland, Kyrgyzstan, the Czech Rep., Romania, Tajikistan, Turkmenistan and Ukraine, the band 8500-8750 MHz is also allocated to the land mobile and radionavigation services on a primary basis. (WRC-12)

**5.469A** In the band 8550-8650 MHz, stations in the Earth exploration-satellite service (active) and space research service (active) shall not cause harmful interference to, or constrain the use and development of, stations of the radiolocation service.

**5.470** The use of the band 8750-8850 MHz by the aeronautical radionavigation service is limited to airborne Doppler navigation aids on a centre frequency of 8800 MHz.

**5.471** *Additional allocation:* in Algeria, Germany, Bahrain, Belgium, China, Egypt, the United Arab Emirates, France, Greece, Indonesia, Iran (Islamic Republic of), Libya, the Netherlands, Qatar and Sudan, the frequency bands 8825-8850 MHz and 9000-9200 MHz are also allocated to the maritime radionavigation service, on a primary basis, for use by shore-based radars only. (WRC-15)

**5.472** In the bands 8850-9000 MHz and 9200-9225 MHz, the maritime radionavigation service is limited to shore-based radars.

**5.473** *Additional allocation:* in Armenia, Austria, Azerbaijan, Belarus, Cuba, the Russian Federation, Georgia, Hungary, Mongolia, Uzbekistan, Poland, Kyrgyzstan, Romania, Tajikistan, Turkmenistan and Ukraine, the bands 8850-9000 MHz and 9200-9300 MHz are also allocated to the radionavigation service on a primary basis. (WRC-07)

**5.473A** In the band 9000-9200 MHz, stations operating in the radiolocation service shall not cause harmful interference to, nor claim protection from, systems identified in No. 5.337 operating in the aeronautical radionavigation service, or radar systems in the maritime radionavigation service operating in this band on a primary basis in the countries listed in No. 5.471. (WRC-07)

**5.474** In the band 9200-9500 MHz, search and rescue transponders (SART) may be used, having due regard to the appropriate ITU-R Recommendation (see also Article 31).

**5.474A** The use of the frequency bands 9200-9300 MHz and 9900-10 400 MHz by the Earth exploration-satellite service (active) is limited to systems requiring necessary bandwidth greater than 600 MHz that cannot be fully accommodated within the frequency band 9300-9900 MHz. Such use is subject to agreement to be obtained under No. 9.21 from Algeria, Saudi Arabia, Bahrain, Egypt, Indonesia, Iran (Islamic Republic of), Lebanon and Tunisia. An administration that has not replied under No. 9.52 is considered as not having agreed to the coordination request. In this case, the notifying administration of the satellite system operating in the Earth exploration-satellite service (active) may request the assistance of the Bureau under Sub-Section IID of Article 9. (WRC-15)

**5.474B** Stations operating in the Earth exploration-satellite (active) service shall comply with Recommendation ITU-R RS.2066-0. (WRC-15)

**5.474C** Stations operating in the Earth exploration-satellite (active) service shall comply with

Recommendation ITU-R RS.2065-0. (WRC-15)

**5.474D** Stations in the Earth exploration-satellite service (active) shall not cause harmful interference to, or claim protection from, stations of the maritime radionavigation and radiolocation services in the frequency band 9200-9300 MHz, the radionavigation and radiolocation services in the frequency band 9900-10 000 MHz and the radiolocation service in the frequency band 10.0-10.4 GHz. (WRC-15)

**5.475** The use of the band 9300-9500 MHz by the aeronautical radionavigation service is limited to airborne weather radars and ground-based radars. In addition, ground-based radar beacons in the aeronautical radionavigation service are permitted in the band 9300-9320 MHz on condition that harmful interference is not caused to the maritime radionavigation service. (WRC-07)

**5.475A** The use of the band 9300-9500 MHz by the Earth exploration-satellite service (active) and the space research service (active) is limited to systems requiring necessary bandwidth greater than 300 MHz that cannot be fully accommodated within the 9500-9800 MHz band. (WRC-07)

**5.475B** In the band 9300-9500 MHz, stations operating in the radiolocation service shall not cause harmful interference to, nor claim protection from, radars operating in the radionavigation service in conformity with the Radio Regulations. Ground-based radars used for meteorological purposes have priority over other radiolocation uses. (WRC-07)

**5.476A** In the band 9300-9800 MHz, stations in the Earth exploration-satellite service (active) and space research service (active) shall not cause harmful interference to, nor claim protection from, stations of the radionavigation and radiolocation services. (WRC-07)

**5.477** *Different category of service:* in Algeria, Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Guyana, India, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Japan, Jordan, Kuwait, Lebanon, Liberia, Malaysia, Nigeria, Oman, Uganda, Pakistan, Qatar, Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, South Sudan, Trinidad and Tobago, and Yemen, the allocation of the frequency band 9800-10 000 MHz to the fixed service is on a primary basis (see No. 5.33). (WRC-15)

**5.478** *Additional allocation:* in Azerbaijan, Mongolia, Kyrgyzstan, Romania, Turkmenistan and Ukraine, the band 9800-10 000 MHz is also allocated to the radionavigation service on a primary basis. (WRC-07)

**5.478A** The use of the band 9800-9900 MHz by the Earth exploration-satellite service (active) and the space research service (active) is limited to systems requiring necessary bandwidth greater than 500 MHz that cannot be fully accommodated within the 9300-9800 MHz band. (WRC-07)

**5.478B** In the band 9800-9900 MHz, stations in the Earth exploration-satellite service (active) and space research service (active) shall not cause harmful interference to, nor claim protection from stations of the fixed service to which this band is allocated on a secondary basis. (WRC-07)

**5.479** The band 9975-10 025 MHz is also allocated to the meteorological-satellite service on a secondary basis for use by weather radars.

**5.480** *Additional allocation:* in Argentina, Brazil, Chile, Cuba, El Salvador, Ecuador, Guatemala, Honduras, Paraguay, the Netherlands Antilles, Peru and Uruguay, the frequency band 10-10.45 GHz is also allocated to the fixed and mobile services on a primary basis. In Colombia, Costa Rica, Mexico and Venezuela, the frequency band 10-10.45 GHz is also allocated to the fixed service on a primary basis. (WRC-15)

**5.481** *Additional allocation:* in Algeria, Germany, Angola, Brazil, China, Côte d'Ivoire, El Salvador, Ecuador, Spain, Guatemala, Hungary, Japan, Kenya, Morocco, Nigeria, Oman, Uzbekistan, Pakistan, Paraguay, Peru, the Dem. People's Rep. of Korea, Romania and Uruguay, the frequency band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis. In Costa Rica, the frequency band 10.45-10.5 GHz is also allocated to the fixed service on a primary basis. (WRC-15)

**5.482** In the band 10.6-10.68 GHz, the power delivered to the antenna of stations of the fixed and mobile, except aeronautical mobile, services shall not exceed –3 dBW. This limit may be exceeded, subject to agreement obtained under No. 9.21. However, in Algeria, Saudi Arabia, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Egypt, United Arab Emirates, Georgia, India, Indonesia, Iran (Islamic Republic of), Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Morocco, Mauritania, Moldova, Nigeria, Oman, Uzbekistan, Pakistan, Philippines, Qatar, Syrian Arab Republic, Kyrgyzstan, Singapore, Tajikistan, Tunisia, Turkmenistan and Viet Nam, this restriction on the fixed and mobile, except aeronautical mobile, services is not applicable. (WRC-07)

**5.482A** For sharing of the band 10.6-10.68 GHz between the Earth exploration-satellite (passive) service and the fixed and mobile, except aeronautical mobile, services, Resolution 751 (WRC-07) applies. (WRC-07)

**5.483** *Additional allocation:* in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, China, Colombia, Korea (Rep. of), Costa Rica, Egypt, the United Arab Emirates, Georgia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kuwait, Lebanon, Mongolia, Qatar, Kyrgyzstan, the Dem. People's Rep. of Korea, Tajikistan, Turkmenistan and Yemen, the band 10.68-10.7 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. Such use is limited to equipment in operation by 1 January 1985. (WRC-12)

**5.484** In Region 1, the use of the band 10.7-11.7 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service.

**5.484A** The use of the bands 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.75 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Region 1, 13.75-14.5 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-28.6 GHz (Earth-to-space), 29.5-30 GHz (Earth-to-space) by a non-geostationary-satellite system in the fixed-satellite service is subject to application of the provisions of No. 9.12 for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite networks, and No. 5.43A does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the above bands shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.

**5.484B** Resolution 155 (WRC-15) shall apply. (WRC-15)

**5.485** In Region 2, in the band 11.7-12.2 GHz, transponders on space stations in the fixed-satellite service may be used additionally for transmissions in the broadcasting-satellite service, provided that such transmissions do not have a maximum e.i.r.p. greater than 53 dBW per television channel and do not cause greater interference or require more protection from interference than the coordinated fixed-satellite service frequency assignments. With respect to the space services, this band shall be used principally for the fixed-satellite service.

**5.486** *Different category of service:* in the United States, the allocation of the frequency band 11.7-12.1 GHz to the fixed service is on a secondary basis (see No. 5.32). (WRC-15)

**5.487** In the band 11.7-12.5 GHz in Regions 1 and 3, the fixed, fixed-satellite, mobile, except aeronautical mobile, and broadcasting services, in accordance with their respective allocations, shall not cause harmful interference to, or claim protection from, broadcasting-satellite stations operating in accordance with the Regions 1 and 3 Plan in Appendix 30.

**5.487A** *Additional allocation:* in Region 1, the band 11.7-12.5 GHz, in Region 2, the band 12.2-12.7 GHz and, in Region 3, the band 11.7-12.2 GHz, are also allocated to the fixed-satellite service (space-to-Earth) on a primary basis, limited to non-geostationary systems and subject to application of the provisions of No. 9.12 for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the broadcasting-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite networks, and No. 5.43A does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the above bands shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.

**5.488** The use of the band 11.7-12.2 GHz by geostationary-satellite networks in the fixed-satellite service in Region 2 is subject to application of the provisions of No. 9.14 for coordination with stations of terrestrial services in Regions 1, 2 and 3. For the use of the band 12.2-12.7 GHz by the broadcasting-satellite service in Region 2, see Appendix 30.

**5.489** *Additional allocation:* in Peru, the band 12.1-12.2 GHz is also allocated to the fixed service on a primary basis.

**5.490** In Region 2, in the band 12.2-12.7 GHz, existing and future terrestrial radiocommunication services shall not cause harmful interference to the space services operating in conformity with the broadcasting-satellite Plan for Region 2 contained in Appendix 30.

**5.492** Assignments to stations of the broadcasting-satellite service which are in conformity with the appropriate regional Plan or included in the Regions 1 and 3 List in Appendix 30 may also be used for transmissions in the fixed-satellite service (space-to-Earth), provided that such transmissions do not cause more interference, or require more protection from interference, than the broadcasting-satellite service transmissions operating in conformity with the Plan or the List, as appropriate.

**5.493** The broadcasting-satellite service in the band 12.5-12.75 GHz in Region 3 is limited to a power flux-density not exceeding  $-111 \text{ dB(W/(m}^2 \cdot 27 \text{ MHz))}$  for all conditions and for all methods of modulation at the edge of the service area.

**5.494** *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Cameroon, the Central African Rep., Congo (Rep. of the), Côte d'Ivoire, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Madagascar, Mali, Morocco, Mongolia, Nigeria, Oman, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the frequency band 12.5-12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-15)

**5.495** *Additional allocation:* in France, Greece, Monaco, Montenegro, Uganda, Romania and Tunisia, the frequency band 12.5-12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis. (WRC-15)

**5.496** *Additional allocation:* in Austria, Azerbaijan, Kyrgyzstan and Turkmenistan, the band 12.5-12.75 GHz is also allocated to the fixed service and the mobile, except aeronautical mobile, service on a primary basis. However, stations in these services shall not cause harmful interference to fixed-satellite service earth stations of countries in Region 1 other than those listed in this footnote. Coordination of these earth stations is not required with stations of the fixed and mobile services of the countries listed in this footnote. The power flux-density limit at the Earth's surface given in Table 21-4 of Article 21, for the fixed-satellite service shall apply on the territory of the countries listed in this footnote.

**5.497** The use of the band 13.25-13.4 GHz by the aeronautical radionavigation service is limited to Doppler navigation aids.

**5.498A** The Earth exploration-satellite (active) and space research (active) services operating in the band 13.25-13.4 GHz shall not cause harmful interference to, or constrain the use and development of, the aeronautical radionavigation service.

**5.499** *Additional allocation:* in Bangladesh and India, the band 13.25-14 GHz is also allocated to the fixed service on a primary basis. In Pakistan, the band 13.25-13.75 GHz is allocated to the fixed service on a primary basis. (WRC-12)

**5.499A** The use of the frequency band 13.4-13.65 GHz by the fixed-satellite service (space-to-Earth) is limited to geostationary-satellite systems and is subject to agreement obtained under No. 9.21 with respect to satellite systems operating in the space research service (space-to-space) to relay data from space stations in the geostationary-satellite orbit to associated space stations in non-geostationary satellite orbits for which advance publication information has been received by the Bureau by 27 November 2015. (WRC-15)

**5.499B** Administrations shall not preclude the deployment and operation of transmitting earth stations in the standard frequency and time signal-satellite service (Earth-to-space) allocated on a secondary basis in the frequency band 13.4-13.65 GHz due to the primary allocation to FSS (space-to-Earth). (WRC-15)

**5.499C** The allocation of the frequency band 13.4-13.65 GHz to the space research service on a primary basis is limited to:

- satellite systems operating in the space research service (space-to-space) to relay data from space stations in the geostationary-satellite orbit to associated space stations in non-geostationary satellite orbits for which advance publication information has been received by the Bureau by 27 November 2015,
- active spaceborne sensors,
- satellite systems operating in the space research service (space-to-Earth) to relay data from space stations in the geostationary-satellite orbit to associated earth stations.

Other uses of the frequency band by the space research service are on a secondary basis. (WRC-15)

**5.499D** In the frequency band 13.4-13.65 GHz, satellite systems in the space research service (space-to-Earth) and/or the space research service (space-to-space) shall not cause harmful interference to, nor claim protection from, stations in the fixed, mobile, radiolocation and Earth exploration-satellite (active) services. (WRC-15)

**5.499E** In the frequency band 13.4-13.65 GHz, geostationary-satellite networks in the fixed-satellite service (space-to-Earth) shall not claim protection from space stations in the Earth exploration-satellite service (active) operating in accordance with these Regulations, and No. 5.43A does not apply. The provisions of No. 22.2 do not apply to the Earth exploration-satellite service (active) with respect to the fixed-satellite service (space-to-Earth) in this frequency band. (WRC-15)

**5.500** *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Brunei Darussalam, Cameroon, Egypt, the United Arab Emirates, Gabon, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Madagascar, Malaysia, Mali, Morocco, Mauritania, Niger, Nigeria, Oman, Qatar, the Syrian Arab Republic, Singapore, Sudan, South Sudan, Chad and Tunisia, the frequency band 13.4-14 GHz is also allocated to the fixed and mobile services on a primary basis. In Pakistan, the frequency band 13.4-13.75 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-15)

**5.501** *Additional allocation:* in Azerbaijan, Hungary, Japan, Kyrgyzstan, Romania and Turkmenistan, the band 13.4-14 GHz is also allocated to the radionavigation service on a primary basis. (WRC-12)

**5.501A** The allocation of the frequency band 13.65-13.75 GHz to the space research service on a primary basis is limited to active spaceborne sensors. Other uses of the frequency band by the space research service are on a secondary basis. (WRC-15)

**5.501B** In the band 13.4-13.75 GHz, the Earth exploration-satellite (active) and space research (active) services shall not cause harmful interference to, or constrain the use and development of, the radiolocation service.

**5.502** In the band 13.75-14 GHz, an earth station of a geostationary fixed-satellite service network shall have a minimum antenna diameter of 1.2 m and an earth station of a non-geostationary fixed-satellite service system shall have a minimum antenna diameter of 4.5 m. In addition, the e.i.r.p., averaged over one second, radiated by a station in the radiolocation or radionavigation services shall not exceed 59 dBW for elevation angles above 2° and 65 dBW at lower angles. Before an administration brings into use an earth station in a geostationary-satellite network in the fixed-satellite service in this band with an antenna diameter smaller than 4.5 m, it shall ensure that the power flux-density produced by this earth station does not exceed:

- $-115 \text{ dB(W/(m}^2 \cdot 10 \text{ MHz))}$  for more than 1% of the time produced at 36 m above sea level at the low water mark, as officially recognized by the coastal State;
- $-115 \text{ dB(W/(m}^2 \cdot 10 \text{ MHz))}$  for more than 1% of the time produced 3 m above ground at the border of the territory of an administration deploying or planning to deploy land mobile radars in this band, unless prior agreement has been obtained.

For earth stations within the fixed-satellite service having an antenna diameter greater than or equal to 4.5 m, the e.i.r.p. of any emission should be at least 68 dBW and should not exceed 85 dBW.

**5.503** In the band 13.75-14 GHz, geostationary space stations in the space research service for which information for advance publication has been received by the Bureau prior to 31 January 1992 shall operate on an equal basis with stations in the fixed-satellite service; after that date, new geostationary space stations in the space research service will operate on a secondary basis. Until those geostationary space stations in the space research service for which information for advance publication has been received by the Bureau prior to 31 January 1992 cease to operate in this band:

- in the band 13.77-13.78 GHz, the e.i.r.p. density of emissions from any earth station in the fixed-satellite service operating with a space station in geostationary-satellite orbit shall not exceed:

i)  $4.7D + 28 \text{ dB (W/40 kHz)}$ , where  $D$  is the fixed-satellite service earth station antenna diameter (m) for antenna diameters equal to or greater than 1.2 m and less than 4.5 m;

ii)  $49.2 + 20 \log (D/4.5) \text{ dB(W/40 kHz)}$ , where  $D$  is the fixed-satellite service earth station antenna diameter (m) for antenna diameters equal to or greater than 4.5 m and less than 31.9 m;

iii)  $66.2 \text{ dB(W/40 kHz)}$  for any fixed-satellite service earth station for antenna diameters (m) equal to or greater than 31.9 m;

iv)  $56.2 \text{ dB(W/4 kHz)}$  for narrow-band (less than 40 kHz of necessary bandwidth) fixed-satellite service earth station emissions from any fixed-satellite service earth station having an antenna diameter of 4.5 m or greater;

- the e.i.r.p. density of emissions from any earth station in the fixed-satellite service operating with a space station in non-geostationary-satellite orbit shall not exceed 51 dBW in the 6 MHz band from 13.772 to 13.778 GHz.

Automatic power control may be used to increase the e.i.r.p. density in these frequency ranges to compensate for rain attenuation, to the extent that the power flux-density at the fixed-satellite service space station does not exceed the value resulting from use by an earth station of an e.i.r.p. meeting the above limits in clear-sky conditions.

**5.504** The use of the band 14-14.3 GHz by the radionavigation service shall be such as to provide sufficient protection to space stations of the fixed-satellite service.

**5.504A** In the band 14-14.5 GHz, aircraft earth stations in the secondary aeronautical mobile-satellite service may also communicate with space stations in the fixed-satellite service. The provisions of Nos. 5.29, 5.30 and 5.31 apply.

**5.504B** Aircraft earth stations operating in the aeronautical mobile-satellite service in the frequency band 14-14.5 GHz shall comply with the provisions of Annex 1, Part C of Recommendation ITU-R M.1643-0, with respect to any radio astronomy station performing observations in the 14.47-14.5 GHz frequency band located on the territory of Spain, France, India, Italy, the United Kingdom and South Africa. (WRC-15)

**5.504C** In the frequency band 14-14.25 GHz, the power flux-density produced on the territory of the countries of Saudi Arabia, Bahrain, Botswana, Côte d'Ivoire, Egypt, Guinea, India, Iran (Islamic Republic of), Kuwait, Nigeria, Oman, the Syrian Arab Republic and Tunisia by any aircraft earth station in the aeronautical mobile-satellite service shall not exceed the limits given in Annex 1, Part B of Recommendation ITU-R M.1643-0, unless otherwise specifically agreed by the affected administration(s). The provisions of this footnote in no way derogate the obligations of the aeronautical mobile-satellite service to operate as a secondary service in accordance with No. 5.29. (WRC-15)

**5.505** *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Botswana, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Djibouti, Egypt, the United Arab Emirates, Gabon, Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Malaysia, Mali, Morocco, Mauritania, Oman, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, South Sudan, Swaziland, Chad, Viet Nam and Yemen, the frequency band 14-14.3 GHz is also allocated to the fixed service on a primary basis. (WRC-15)

**5.506** The band 14-14.5 GHz may be used, within the fixed-satellite service (Earth-to-space), for feeder links for the broadcasting-satellite service, subject to coordination with other networks in the fixed-satellite service. Such use of feeder links is reserved for countries outside Europe.

**5.506A** In the band 14-14.5 GHz, ship earth stations with an e.i.r.p. greater than 21 dBW shall operate under the same conditions as earth stations located on board vessels, as provided in Resolution 902 (WRC-03). This footnote shall not apply to ship earth stations for which the complete Appendix 4 information has been received by the Bureau prior to 5 July 2003.

**5.506B** Earth stations located on board vessels communicating with space stations in the fixed-satellite service may operate in the frequency band 14-14.5 GHz without the need for prior agreement from Cyprus and Malta, within the minimum distance given in Resolution 902 (WRC-03) from these countries. (WRC-15)

**5.508** *Additional allocation:* in Germany, France, Italy, Libya, The Former Yugoslav Rep. of Macedonia and the United Kingdom, the band 14.25-14.3 GHz is also allocated to the fixed service on a primary basis. (WRC-12)

**5.508A** In the frequency band 14.25-14.3 GHz, the power flux-density produced on the territory of the countries of Saudi Arabia, Bahrain, Botswana, China, Côte d'Ivoire, Egypt, France, Guinea, India, Iran (Islamic Republic of), Italy, Kuwait, Nigeria, Oman, the Syrian Arab Republic, the United Kingdom and Tunisia by any aircraft earth station in the aeronautical mobile-satellite service shall not exceed the limits given in Annex 1, Part B of Recommendation ITU-R M.1643-0, unless otherwise specifically agreed by the affected administration(s). The provisions of this footnote in no way derogate the obligations of the aeronautical mobile-satellite service to operate as a secondary service in accordance with No. 5.29. (WRC-15)

**5.509A** In the frequency band 14.3-14.5 GHz, the power flux-density produced on the territory of the countries of Saudi Arabia, Bahrain, Botswana, Cameroon, China, Côte d'Ivoire, Egypt, France, Gabon, Guinea, India, Iran (Islamic Republic of), Italy, Kuwait, Morocco, Nigeria, Oman, the Syrian Arab Republic, the United Kingdom, Sri Lanka, Tunisia and Viet Nam by any aircraft earth station in the aeronautical mobile-satellite service shall not exceed the limits given in Annex 1, Part B of Recommendation ITU-R M.1643-0, unless otherwise specifically agreed by the affected administration(s). The provisions of this footnote in no way derogate the obligations of the aeronautical mobile-satellite

service to operate as a secondary service in accordance with No. 5.29. (WRC-15)

**5.509B** The use of the frequency bands 14.5-14.75 GHz in countries listed in Resolution 163 (WRC-15) and 14.5-14.8 GHz in countries listed in Resolution 164 (WRC-15) by the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service is limited to geostationary-satellites. (WRC-15)

**5.509C** For the use of the frequency bands 14.5-14.75 GHz in countries listed in Resolution 163 (WRC-15) and 14.5-14.8 GHz in countries listed in Resolution 164 (WRC-15) by the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service, the fixed-satellite service earth stations shall have a minimum antenna diameter of 6 m and a maximum power spectral density of  $-44.5$  dBW/Hz at the input of the antenna. The earth stations shall be notified at known locations on land. (WRC-15)

**5.509D** Before an administration brings into use an earth station in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service in the frequency bands 14.5-14.75 GHz (in countries listed in Resolution 163 (WRC-15)) and 14.5-14.8 GHz (in countries listed in Resolution 164 (WRC-15)), it shall ensure that the power flux-density produced by this earth station does not exceed  $-151.5$  dB(W/(m<sup>2</sup> · 4 kHz)) produced at all altitudes from 0 m to 19000 m above sea level at 22 km seaward from all coasts, defined as the low-water mark, as officially recognized by each coastal State. (WRC-15)

**5.509E** In the frequency bands 14.50-14.75 GHz in countries listed in Resolution 163 (WRC-15) and 14.50-14.8 GHz in countries listed in Resolution 164 (WRC-15), the location of earth stations in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service shall maintain a separation distance of at least 500 km from the border(s) of other countries unless shorter distances are explicitly agreed by those administrations. No. 9.17 does not apply. When applying this provision, administrations should consider the relevant parts of these Regulations and the latest relevant ITU-R Recommendations. (WRC-15)

**5.509F** In the frequency bands 14.50-14.75 GHz in countries listed in Resolution 163 (WRC-15) and 14.50-14.8 GHz in countries listed in Resolution 164 (WRC-15), earth stations in the fixed-satellite service (Earth-to-space) not for feeder links for the broadcasting-satellite service shall not constrain the future deployment of the fixed and mobile services. (WRC-15)

**5.509G** The frequency band 14.5-14.8 GHz is also allocated to the space research service on a primary basis. However, such use is limited to the satellite systems operating in the space research service (Earth-to-space) to relay data to space stations in the geostationary-satellite orbit from associated earth stations. Stations in the space research service shall not cause harmful interference to, or claim protection from, stations in the fixed and mobile services and in the fixed-satellite service limited to feeder links for the broadcasting-satellite service and associated space operations functions using the guardbands under Appendix 30A and feeder links for the broadcasting-satellite service in Region 2. Other uses of this frequency band by the space research service are on a secondary basis. (WRC-15)

**5.510** Except for use in accordance with Resolution 163 (WRC-15) and Resolution 164 (WRC-15), the use of the frequency band 14.5-14.8 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. This use is reserved for countries outside Europe. Uses other than feeder links for the broadcasting-satellite service are not authorized in Regions 1 and 2 in the frequency band 14.75-14.8 GHz. (WRC-15)

**5.511** *Additional allocation:* in Saudi Arabia, Bahrain, Cameroon, Egypt, the United Arab Emirates, Guinea, Iran (Islamic Republic of), Iraq, Israel, Kuwait, Lebanon, Oman, Pakistan, Qatar, the Syrian Arab Republic and Somalia, the band 15.35-15.4 GHz is also allocated to the fixed and mobile services on a secondary basis. (WRC-12)



**5.511A** Use of the frequency band 15.43-15.63 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links of non-geostationary systems in the mobile-satellite service, subject to coordination under No. 9.11A. (WRC-15)

**5.511C** Stations operating in the aeronautical radionavigation service shall limit the effective e.i.r.p. in accordance with Recommendation ITU-R S.1340-0. The minimum coordination distance required to protect the aeronautical radionavigation stations (No. 4.10 applies) from harmful interference from feeder-link earth stations and the maximum e.i.r.p. transmitted towards the local horizontal plane by a feeder-link earth station shall be in accordance with Recommendation ITU-R S.1340-0. (WRC-15)

**5.511E** In the frequency band 15.4-15.7 GHz, stations operating in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the aeronautical radionavigation service. (WRC-12)

**5.511F** In order to protect the radio astronomy service in the frequency band 15.35-15.4 GHz, radiolocation stations operating in the frequency band 15.4-15.7 GHz shall not exceed the power flux-density level of  $-156 \text{ dB(W/m}^2\text{)}$  in a 50 MHz bandwidth in the frequency band 15.35-15.4 GHz, at any radio astronomy observatory site for more than 2 per cent of the time. (WRC-12)

**5.512** *Additional allocation:* in Algeria, Saudi Arabia, Austria, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, Congo (Rep. of the), Egypt, El Salvador, the United Arab Emirates, Eritrea, Finland, Guatemala, India, Indonesia, Iran (Islamic Republic of), Jordan, Kenya, Kuwait, Lebanon, Libya, Malaysia, Mali, Morocco, Mauritania, Montenegro, Nepal, Nicaragua, Niger, Oman, Pakistan, Qatar, Syrian Arab Republic, the Dem. Rep. of the Congo, Singapore, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the frequency band 15.7-17.3 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-15)

**5.513** *Additional allocation:* in Israel, the band 15.7-17.3 GHz is also allocated to the fixed and mobile services on a primary basis. These services shall not claim protection from or cause harmful interference to services operating in accordance with the Table in countries other than those included in No. 5.512.

**5.513A** Spaceborne active sensors operating in the band 17.2-17.3 GHz shall not cause harmful interference to, or constrain the development of, the radiolocation and other services allocated on a primary basis.

**5.514** *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Bangladesh, Cameroon, El Salvador, the United Arab Emirates, Guatemala, India, Iran (Islamic Republic of), Iraq, Israel, Italy, Japan, Jordan, Kuwait, Libya, Lithuania, Nepal, Nicaragua, Nigeria, Oman, Uzbekistan, Pakistan, Qatar, Kyrgyzstan, Sudan and South Sudan, the frequency band 17.3-17.7 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits given in Nos. 21.3 and 21.5 shall apply. (WRC-15)

**5.515** In the band 17.3-17.8 GHz, sharing between the fixed-satellite service (Earth-to-space) and the broadcasting-satellite service shall also be in accordance with the provisions of § 1 of Annex 4 of Appendix 30A.

**5.516** The use of the band 17.3-18.1 GHz by geostationary-satellite systems in the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. The use of the band 17.3-17.8 GHz in Region 2 by systems in the fixed-satellite service (Earth-to-space) is limited to geostationary satellites. For the use of the band 17.3-17.8 GHz in Region 2 by feeder links for the broadcasting-satellite service in the band 12.2-12.7 GHz, see Article 11. The use of the bands 17.3-18.1 GHz (Earth-to-space) in Regions 1 and 3 and 17.8-18.1 GHz (Earth-to-space) in Region 2 by non-geostationary-satellite systems in the fixed-satellite service is subject to application of the provisions of No. 9.12 for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations, irrespective of the dates of receipt by the

Bureau of the complete coordination or notification information, as appropriate, for the non-geostationary-satellite systems in the fixed-satellite service and of the complete coordination or notification information, as appropriate, for the geostationary-satellite networks, and No. 5.43A does not apply. Non-geostationary-satellite systems in the fixed-satellite service in the above bands shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.

**5.516A** In the band 17.3-17.7 GHz, earth stations of the fixed-satellite service (space-to-Earth) in Region 1 shall not claim protection from the broadcasting-satellite service feeder-link earth stations operating under Appendix 30A, nor put any limitations or restrictions on the locations of the broadcasting-satellite service feeder-link earth stations anywhere within the service area of the feeder link.

**5.516B** The following bands are identified for use by high-density applications in the fixed-satellite service:

17.3-17.7 GHz (space-to-Earth) in Region 1,  
18.3-19.3 GHz (space-to-Earth) in Region 2,  
19.7-20.2 GHz (space-to-Earth) in all Regions,  
39.5-40 GHz (space-to-Earth) in Region 1,  
40-40.5 GHz (space-to-Earth) in all Regions,  
40.5-42 GHz (space-to-Earth) in Region 2,  
47.5-47.9 GHz (space-to-Earth) in Region 1,  
48.2-48.54 GHz (space-to-Earth) in Region 1,  
49.44-50.2 GHz (space-to-Earth) in Region 1, and  
27.5-27.82 GHz (Earth-to-space) in Region 1,  
28.35-28.45 GHz (Earth-to-space) in Region 2,  
28.45-28.94 GHz (Earth-to-space) in all Regions,  
28.94-29.1 GHz (Earth-to-space) in Region 2 and 3,  
29.25-29.46 GHz (Earth-to-space) in Region 2,  
29.46-30 GHz (Earth-to-space) in all Regions,  
48.2-50.2 GHz (Earth-to-space) in Region 2.

This identification does not preclude the use of these bands by other fixed-satellite service applications or by other services to which these bands are allocated on a co-primary basis and does not establish priority in these Radio Regulations among users of the bands. Administrations should take this into account when considering regulatory provisions in relation to these bands. See Resolution 143 (Rev.WRC-07). (FCC)

**5.517** In Region 2, use of the fixed-satellite (space-to-Earth) service in the band 17.7-17.8 GHz shall not cause harmful interference to nor claim protection from assignments in the broadcasting-satellite service operating in conformity with the Radio Regulations. (WRC-07)

**5.519** *Additional allocation:* the bands 18-18.3 GHz in Region 2 and 18.1-18.4 GHz in Regions 1 and 3 are also allocated to the meteorological-satellite service (space-to-Earth) on a primary basis. Their use is limited to geostationary satellites. (WRC-07)

**5.520** The use of the band 18.1-18.4 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links of geostationary-satellite systems in the broadcasting-satellite service.

**5.521** *Alternative allocation:* in the United Arab Emirates and Greece, the frequency band 18.1-18.4 GHz is allocated to the fixed, fixed-satellite (space-to-Earth) and mobile services on a primary basis (see No. 5.33). The provisions of No. 5.519 also apply. (WRC-15)

**5.522A** The emissions of the fixed service and the fixed-satellite service in the band 18.6-18.8 GHz are limited to the values given in Nos. 21.5A and 21.16.2, respectively.

**5.522B** The use of the band 18.6-18.8 GHz by the fixed-satellite service is limited to geostationary systems and systems with an orbit of apogee greater than 20 000 km.

**5.522C** In the band 18.6-18.8 GHz, in Algeria, Saudi Arabia, Bahrain, Egypt, the United Arab Emirates, Jordan, Lebanon, Libya, Morocco, Oman, Qatar, the Syrian Arab Republic, Tunisia and Yemen, fixed-service systems in operation at the date of entry into force of the Final Acts of WRC-2000 are not subject to the limits of No. 21.5A.

**5.523A** The use of the bands 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) by geostationary and non-geostationary fixed-satellite service networks is subject to the application of the provisions of No. 9.11A and No. 22.2 does not apply. Administrations having geostationary-satellite networks under coordination prior to 18 November 1995 shall cooperate to the maximum extent possible to coordinate pursuant to No. 9.11A with non-geostationary-satellite networks for which notification information has been received by the Bureau prior to that date, with a view to reaching results acceptable to all the parties concerned. Non-geostationary-satellite networks shall not cause unacceptable interference to geostationary fixed-satellite service networks for which complete Appendix 4 notification information is considered as having been received by the Bureau prior to 18 November 1995.

**5.523B** The use of the band 19.3-19.6 GHz (Earth-to-space) by the fixed-satellite service is limited to feeder links for non-geostationary-satellite systems in the mobile-satellite service. Such use is subject to the application of the provisions of No. 9.11A, and No. 22.2 does not apply.

**5.523C** No. 22.2 shall continue to apply in the bands 19.3-19.6 GHz and 29.1-29.4 GHz, between feeder links of non-geostationary mobile-satellite service networks and those fixed-satellite service networks for which complete Appendix 4 coordination information, or notification information, is considered as having been received by the Bureau prior to 18 November 1995.

**5.523D** The use of the band 19.3-19.7 GHz (space-to-Earth) by geostationary fixed-satellite service systems and by feeder links for non-geostationary-satellite systems in the mobile-satellite service is subject to the application of the provisions of No. 9.11A, but not subject to the provisions of No. 22.2. The use of this band for other non-geostationary fixed-satellite service systems, or for the cases indicated in Nos. 5.523C and 5.523E, is not subject to the provisions of No. 9.11A and shall continue to be subject to Articles 9 (except No. 9.11A) and 11 procedures, and to the provisions of No. 22.2.

**5.523E** No. 22.2 shall continue to apply in the bands 19.6-19.7 GHz and 29.4-29.5 GHz, between feeder links of non-geostationary mobile-satellite service networks and those fixed-satellite service networks for which complete Appendix 4 coordination information, or notification information, is considered as having been received by the Bureau by 21 November 1997.

**5.524** *Additional allocation:* in Afghanistan, Algeria, Saudi Arabia, Bahrain, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Costa Rica, Egypt, the United Arab Emirates, Gabon, Guatemala, Guinea, India, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Malaysia, Mali, Morocco, Mauritania, Nepal, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, South Sudan, Chad, Togo and Tunisia, the frequency band 19.7-21.2 GHz is also allocated to the fixed and mobile services on a primary basis. This additional use shall not impose any limitation on the power flux-density of space stations in the fixed-satellite service in the frequency band 19.7-21.2 GHz and of space stations in the mobile-satellite service in the frequency band 19.7-20.2 GHz where the allocation to the mobile-satellite service is on a primary basis in the latter frequency band. (WRC-15)

**5.525** In order to facilitate interregional coordination between networks in the mobile-satellite and fixed-satellite services, carriers in the mobile-satellite service that are most susceptible to interference shall, to the extent practicable, be located in the higher parts of the bands 19.7-20.2 GHz and 29.5-30 GHz.

**5.526** In the bands 19.7-20.2 GHz and 29.5-30 GHz in Region 2, and in the bands 20.1-20.2 GHz and 29.9-30 GHz in Regions 1 and 3, networks which are both in the fixed-satellite service and in the mobile-satellite service may include links between earth stations at specified or unspecified points or while in motion, through one or more satellites for point-to-point and point-to-multipoint communications.

**5.527** In the bands 19.7-20.2 GHz and 29.5-30 GHz, the provisions of No. 4.10 do not apply with respect to the mobile-satellite service.

**5.527A** The operation of earth stations in motion communicating with the FSS is subject to Resolution 156 (WRC-15). (WRC-15)

**5.528** The allocation to the mobile-satellite service is intended for use by networks which use narrow spot-beam antennas and other advanced technology at the space stations. Administrations operating systems in the mobile-satellite service in the band 19.7-20.1 GHz in Region 2 and in the band 20.1-20.2 GHz shall take all practicable steps to ensure the continued availability of these bands for administrations operating fixed and mobile systems in accordance with the provisions of No. 5.524.

**5.529** The use of the bands 19.7-20.1 GHz and 29.5-29.9 GHz by the mobile-satellite service in Region 2 is limited to satellite networks which are both in the fixed-satellite service and in the mobile-satellite service as described in No. 5.526.

**5.530A** Unless otherwise agreed between the administrations concerned, any station in the fixed or mobile services of an administration shall not produce a power flux-density in excess of  $-120.4 \text{ dB(W/(m}^2 \cdot \text{MHz))}$  at 3 m above the ground of any point of the territory of any other administration in Regions 1 and 3 for more than 20% of the time. In conducting the calculations, administrations should use the most recent version of Recommendation ITU-R P.452 (see also the most recent version of Recommendation ITU-R BO.1898). (WRC-15)

**5.530B** In the band 21.4-22 GHz, in order to facilitate the development of the broadcasting-satellite service, administrations in Regions 1 and 3 are encouraged not to deploy stations in the mobile service and are encouraged to limit the deployment of stations in the fixed service to point-to-point links. (WRC-12)

**5.530D** See Resolution 555 (Rev.WRC-15). (FCC)

**5.531** *Additional allocation:* in Japan, the band 21.4-22 GHz is also allocated to the broadcasting service on a primary basis.

**5.532** The use of the band 22.21-22.5 GHz by the Earth exploration-satellite (passive) and space research (passive) services shall not impose constraints upon the fixed and mobile, except aeronautical mobile, services.

**5.532A** The location of earth stations in the space research service shall maintain a separation distance of at least 54 km from the respective border(s) of neighbouring countries to protect the existing and future deployment of fixed and mobile services unless a shorter distance is otherwise agreed between the corresponding administrations. Nos. 9.17 and 9.18 do not apply. (WRC-12)

**5.532B** Use of the band 24.65-25.25 GHz in Region 1 and the band 24.65-24.75 GHz in Region 3 by the fixed-satellite service (Earth-to-space) is limited to earth stations using a minimum antenna diameter of 4.5 m. (WRC-12)

**5.533** The inter-satellite service shall not claim protection from harmful interference from airport surface detection equipment stations of the radionavigation service.

**5.535** In the band 24.75-25.25 GHz, feeder links to stations of the broadcasting-satellite service shall have priority over other uses in the fixed-satellite service (Earth-to-space). Such other uses shall protect and shall not claim protection from existing and future operating feeder-link networks to such broadcasting satellite stations.

**5.535A** The use of the band 29.1-29.5 GHz (Earth-to-space) by the fixed-satellite service is limited to geostationary-satellite systems and feeder links to non-geostationary-satellite systems in the mobile-satellite service. Such use is subject to the application of the provisions of No. 9.11A, but not subject to the provisions of No. 22.2, except as indicated in Nos. 5.523C and 5.523E where such use is not

subject to the provisions of No. 9.11A and shall continue to be subject to Articles 9 (except No. 9.11A) and 11 procedures, and to the provisions of No. 22.2.

**5.536** Use of the 25.25-27.5 GHz band by the inter-satellite service is limited to space research and Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space.

**5.536A** Administrations operating earth stations in the Earth exploration-satellite service or the space research service shall not claim protection from stations in the fixed and mobile services operated by other administrations. In addition, earth stations in the Earth exploration-satellite service or in the space research service should be operated taking into account the most recent version of Recommendation ITU-R SA.1862. (WRC-12)

**5.536B** In Saudi Arabia, Austria, Bahrain, Belgium, Brazil, China, Korea (Rep. of), Denmark, Egypt, United Arab Emirates, Estonia, Finland, Hungary, India, Iran (Islamic Republic of), Ireland, Israel, Italy, Jordan, Kenya, Kuwait, Lebanon, Libya, Lithuania, Moldova, Norway, Oman, Uganda, Pakistan, the Philippines, Poland, Portugal, the Syrian Arab Republic, Dem. People's Rep. of Korea, Slovakia, the Czech Rep., Romania, the United Kingdom, Singapore, Sweden, Tanzania, Turkey, Viet Nam and Zimbabwe, earth stations operating in the Earth exploration-satellite service in the frequency band 25.5-27 GHz shall not claim protection from, or constrain the use and deployment of, stations of the fixed and mobile services. (WRC-15)

**5.536C** In Algeria, Saudi Arabia, Bahrain, Botswana, Brazil, Cameroon, Comoros, Cuba, Djibouti, Egypt, United Arab Emirates, Estonia, Finland, Iran (Islamic Republic of), Israel, Jordan, Kenya, Kuwait, Lithuania, Malaysia, Morocco, Nigeria, Oman, Qatar, Syrian Arab Republic, Somalia, Sudan, South Sudan, Tanzania, Tunisia, Uruguay, Zambia and Zimbabwe, earth stations operating in the space research service in the band 25.5-27 GHz shall not claim protection from, or constrain the use and deployment of, stations of the fixed and mobile services. (WRC-12)

**5.537** Space services using non-geostationary satellites operating in the inter-satellite service in the band 27-27.5 GHz are exempt from the provisions of No. 22.2.

**5.537A** In Bhutan, Cameroon, Korea (Rep. of), the Russian Federation, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Kazakhstan, Malaysia, Maldives, Mongolia, Myanmar, Uzbekistan, Pakistan, the Philippines, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, Sri Lanka, Thailand and Viet Nam, the allocation to the fixed service in the band 27.9-28.2 GHz may also be used by high altitude platform stations (HAPS) within the territory of these countries. Such use of 300 MHz of the fixed-service allocation by HAPS in the above countries is further limited to operation in the HAPS-to-ground direction and shall not cause harmful interference to, nor claim protection from, other types of fixed-service systems or other co-primary services. Furthermore, the development of these other services shall not be constrained by HAPS. See Resolution 145 (Rev.WRC-12). (WRC-12)

**5.538** *Additional allocation:* the bands 27.500-27.501 GHz and 29.999-30.000 GHz are also allocated to the fixed-satellite service (space-to-Earth) on a primary basis for the beacon transmissions intended for up-link power control. Such space-to-Earth transmissions shall not exceed an equivalent isotropically radiated power (e.i.r.p.) of +10 dBW in the direction of adjacent satellites on the geostationary-satellite orbit. (WRC-07)

**5.539** The band 27.5-30 GHz may be used by the fixed-satellite service (Earth-to-space) for the provision of feeder links for the broadcasting-satellite service.

**5.540** *Additional allocation:* the band 27.501-29.999 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a secondary basis for beacon transmissions intended for up-link power control.

**5.541** In the band 28.5-30 GHz, the earth exploration-satellite service is limited to the transfer of data between stations and not to the primary collection of information by means of active or passive sensors.

**5.541A** Feeder links of non-geostationary networks in the mobile-satellite service and geostationary networks in the fixed-satellite service operating in the band 29.1-29.5 GHz (Earth-to-space) shall employ uplink adaptive power control or other methods of fade compensation, such that the earth station transmissions shall be conducted at the power level required to meet the desired link performance while reducing the level of mutual interference between both networks. These methods shall apply to networks for which Appendix 4 coordination information is considered as having been received by the Bureau after 17 May 1996 and until they are changed by a future competent world radiocommunication conference. Administrations submitting Appendix 4 information for coordination before this date are encouraged to utilize these techniques to the extent practicable.

**5.542** *Additional allocation:* in Algeria, Saudi Arabia, Bahrain, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Egypt, the United Arab Emirates, Eritrea, Ethiopia, Guinea, India, Iran (Islamic Republic of), Iraq, Japan, Jordan, Kuwait, Lebanon, Malaysia, Mali, Morocco, Mauritania, Nepal, Oman, Pakistan, Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Somalia, Sudan, South Sudan, Sri Lanka and Chad, the band 29.5-31 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits specified in Nos. 21.3 and 21.5 shall apply. (WRC-12)

**5.543** The band 29.95-30 GHz may be used for space-to-space links in the Earth exploration-satellite service for telemetry, tracking, and control purposes, on a secondary basis.

**5.543A** In Bhutan, Cameroon, Korea (Rep. of), the Russian Federation, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Kazakhstan, Malaysia, Maldives, Mongolia, Myanmar, Uzbekistan, Pakistan, the Philippines, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, Sri Lanka, Thailand and Viet Nam, the allocation to the fixed service in the frequency band 31-31.3 GHz may also be used by systems using high altitude platform stations (HAPS) in the ground-to-HAPS direction. The use of the frequency band 31-31.3 GHz by systems using HAPS is limited to the territory of the countries listed above and shall not cause harmful interference to, nor claim protection from, other types of fixed-service systems, systems in the mobile service and systems operated under No. 5.545. Furthermore, the development of these services shall not be constrained by HAPS. Systems using HAPS in the frequency band 31-31.3 GHz shall not cause harmful interference to the radio astronomy service having a primary allocation in the frequency band 31.3-31.8 GHz, taking into account the protection criterion as given in the most recent version of Recommendation ITU-R RA.769. In order to ensure the protection of satellite passive services, the level of unwanted power density into a HAPS ground station antenna in the frequency band 31.3-31.8 GHz shall be limited to  $-106$  dB(W/MHz) under clear-sky conditions, and may be increased up to  $-100$  dB(W/MHz) under rainy conditions to mitigate fading due to rain, provided the effective impact on the passive satellite does not exceed the impact under clear-sky conditions. See Resolution 145 (Rev.WRC-12). (WRC-15)

**5.544** In the band 31-31.3 GHz the power flux-density limits specified in Article 21, Table 21-4 shall apply to the space research service.

**5.545** *Different category of service:* in Armenia, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 31-31.3 GHz to the space research service is on a primary basis (see No. 5.33). (WRC-12)

**5.546** *Different category of service:* in Saudi Arabia, Armenia, Azerbaijan, Belarus, Egypt, the United Arab Emirates, Spain, Estonia, the Russian Federation, Georgia, Hungary, Iran (Islamic Republic of), Israel, Jordan, Lebanon, Moldova, Mongolia, Oman, Uzbekistan, Poland, the Syrian Arab Republic, Kyrgyzstan, Romania, the United Kingdom, South Africa, Tajikistan, Turkmenistan and Turkey, the allocation of the band 31.5-31.8 GHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. 5.33). (WRC-12)

**5.547** The bands 31.8-33.4 GHz, 37-40 GHz, 40.5-43.5 GHz, 51.4-52.6 GHz, 55.78-59 GHz and 64-66 GHz are available for high-density applications in the fixed service (see Resolution 75 (WRC-12)). Administrations should take this into account when considering regulatory provisions in relation to these

bands. Because of the potential deployment of high-density applications in the fixed-satellite service in the bands 39.5-40 GHz and 40.5-42 GHz (see No. 5.516B), administrations should further take into account potential constraints to high-density applications in the fixed service, as appropriate. (FCC)

**5.547A** Administrations should take practical measures to minimize the potential interference between stations in the fixed service and airborne stations in the radionavigation service in the 31.8-33.4 GHz band, taking into account the operational needs of the airborne radar systems.

**5.547B** *Alternative allocation:* in the United States, the band 31.8-32 GHz is allocated to the radionavigation and space research (deep space) (space-to-Earth) services on a primary basis.

**5.547C** *Alternative allocation:* in the United States, the band 32-32.3 GHz is allocated to the radionavigation and space research (deep space) (space-to-Earth) services on a primary basis.

**5.547D** *Alternative allocation:* in the United States, the band 32.3-33 GHz is allocated to the inter-satellite and radionavigation services on a primary basis.

**5.547E** *Alternative allocation:* in the United States, the band 33-33.4 GHz is allocated to the radionavigation service on a primary basis.

**5.548** In designing systems for the inter-satellite service in the band 32.3-33 GHz, for the radionavigation service in the band 32-33 GHz, and for the space research service (deep space) in the band 31.8-32.3 GHz, administrations shall take all necessary measures to prevent harmful interference between these services, bearing in mind the safety aspects of the radionavigation service (see Recommendation 707).

**5.549** *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Egypt, the United Arab Emirates, Gabon, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malaysia, Mali, Morocco, Mauritania, Nepal, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, Singapore, Somalia, Sudan, South Sudan, Sri Lanka, Togo, Tunisia and Yemen, the band 33.4-36 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

**5.549A** In the band 35.5-36.0 GHz, the mean power flux-density at the Earth's surface, generated by any spaceborne sensor in the Earth exploration-satellite service (active) or space research service (active), for any angle greater than 0.8° from the beam centre shall not exceed  $-73.3$  dB(W/m<sup>2</sup>) in this band.

**5.550** *Different category of service:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 34.7-35.2 GHz to the space research service is on a primary basis (see No. 5.33). (WRC-12)

**5.550A** For sharing of the band 36-37 GHz between the Earth exploration-satellite (passive) service and the fixed and mobile services, Resolution 752 (WRC-07) shall apply. (WRC-07)

**5.551F** *Different category of service:* in Japan, the allocation of the band 41.5-42.5 GHz to the mobile service is on a primary basis (see No. 5.33).

**5.551H** The equivalent power flux-density (epfd) produced in the frequency band 42.5-43.5 GHz by all space stations in any non-geostationary-satellite system in the fixed-satellite service (space-to-Earth), or in the broadcasting-satellite service operating in the frequency band 42-42.5 GHz, shall not exceed the following values at the site of any radio astronomy station for more than 2% of the time:

$-230$  dB(W/m<sup>2</sup>) in 1 GHz and  $-246$  dB(W/m<sup>2</sup>) in any 500 kHz of the frequency band 42.5-43.5 GHz at the site of any radio astronomy station registered as a single-dish telescope; and

$-209$  dB(W/m<sup>2</sup>) in any 500 kHz of the frequency band 42.5-43.5 GHz at the site of any radio astronomy station registered as a very long baseline interferometry station.

These epfd values shall be evaluated using the methodology given in Recommendation ITU-R S.1586-1 and the reference antenna pattern and the maximum gain of an antenna in the radio astronomy service given in Recommendation ITU-R RA.1631-0 and shall apply over the whole sky and for elevation angles higher

than the minimum operating angle  $\theta_{min}$  of the radiotelescope (for which a default value of  $5^\circ$  should be adopted in the absence of notified information).

These values shall apply at any radio astronomy station that either:

- was in operation prior to 5 July 2003 and has been notified to the Bureau before 4 January 2004; or
- was notified before the date of receipt of the complete Appendix 4 information for coordination or notification, as appropriate, for the space station to which the limits apply.

Other radio astronomy stations notified after these dates may seek an agreement with administrations that have authorized the space stations. In Region 2, Resolution 743 (WRC-03) shall apply. The limits in this footnote may be exceeded at the site of a radio astronomy station of any country whose administration so agreed. (WRC-15)

**5.551I** The power flux-density in the band 42.5-43.5 GHz produced by any geostationary space station in the fixed-satellite service (space-to-Earth), or the broadcasting-satellite service operating in the 42-42.5 GHz band, shall not exceed the following values at the site of any radio astronomy station:

- 137 dB(W/m<sup>2</sup>) in 1 GHz and –153 dB(W/m<sup>2</sup>) in any 500 kHz of the 42.5-43.5 GHz band at the site of any radio astronomy station registered as a single-dish telescope; and
- 116 dB(W/m<sup>2</sup>) in any 500 kHz of the 42.5-43.5 GHz band at the site of any radio astronomy station registered as a very long baseline interferometry station.

These values shall apply at the site of any radio astronomy station that either:

- was in operation prior to 5 July 2003 and has been notified to the Bureau before 4 January 2004; or
- was notified before the date of receipt of the complete Appendix 4 information for coordination or notification, as appropriate, for the space station to which the limits apply.

Other radio astronomy stations notified after these dates may seek an agreement with administrations that have authorized the space stations. In Region 2, Resolution 743 (WRC-03) shall apply. The limits in this footnote may be exceeded at the site of a radio astronomy station of any country whose administration so agreed.

**5.552** The allocation of the spectrum for the fixed-satellite service in the bands 42.5-43.5 GHz and 47.2-50.2 GHz for Earth-to-space transmission is greater than that in the band 37.5-39.5 GHz for space-to-Earth transmission in order to accommodate feeder links to broadcasting satellites. Administrations are urged to take all practicable steps to reserve the band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service operating in the band 40.5-42.5 GHz.

**5.552A** The allocation to the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz is designated for use by high altitude platform stations. The use of the bands 47.2-47.5 GHz and 47.9-48.2 GHz is subject to the provisions of Resolution 122 (Rev.WRC-07). (WRC-07)

**5.553** In the bands 43.5-47 GHz and 66-71 GHz, stations in the land mobile service may be operated subject to not causing harmful interference to the space radiocommunication services to which these bands are allocated (see No. 5.43).

**5.554** In the bands 43.5-47 GHz, 66-71 GHz, 95-100 GHz, 123-130 GHz, 191.8-200 GHz and 252-265 GHz, satellite links connecting land stations at specified fixed points are also authorized when used in conjunction with the mobile-satellite service or the radionavigation-satellite service.

**5.554A** The use of the bands 47.5-47.9 GHz, 48.2-48.54 GHz and 49.44-50.2 GHz by the fixed-satellite service (space-to-Earth) is limited to geostationary satellites.

**5.555** *Additional allocation:* the band 48.94-49.04 GHz is also allocated to the radio astronomy service on a primary basis.



**5.555B** The power flux-density in the band 48.94-49.04 GHz produced by any geostationary space station in the fixed-satellite service (space-to-Earth) operating in the bands 48.2-48.54 GHz and 49.44-50.2 GHz shall not exceed  $-151.8 \text{ dB(W/m}^2\text{)}$  in any 500 kHz band at the site of any radio astronomy station.

**5.556** In the bands 51.4-54.25 GHz, 58.2-59 GHz and 64-65 GHz, radio astronomy observations may be carried out under national arrangements.

**5.556A** Use of the bands 54.25-56.9 GHz, 57-58.2 GHz and 59-59.3 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density at all altitudes from 0 km to 1000 km above the Earth's surface produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, shall not exceed  $-147 \text{ dB(W/(m}^2 \cdot 100 \text{ MHz))}$  for all angles of arrival.

**5.556B** *Additional allocation:* in Japan, the band 54.25-55.78 GHz is also allocated to the mobile service on a primary basis for low-density use.

**5.557** *Additional allocation:* in Japan, the band 55.78-58.2 GHz is also allocated to the radiolocation service on a primary basis.

**5.557A** In the band 55.78-56.26 GHz, in order to protect stations in the Earth exploration-satellite service (passive), the maximum power density delivered by a transmitter to the antenna of a fixed service station is limited to  $-26 \text{ dB(W/MHz)}$ .

**5.558** In the bands 55.78-58.2 GHz, 59-64 GHz, 66-71 GHz, 122.25-123 GHz, 130-134 GHz, 167-174.8 GHz and 191.8-200 GHz, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. 5.43).

**5.558A** Use of the band 56.9-57 GHz by inter-satellite systems is limited to links between satellites in geostationary-satellite orbit and to transmissions from non-geostationary satellites in high-Earth orbit to those in low-Earth orbit. For links between satellites in the geostationary-satellite orbit, the single entry power flux-density at all altitudes from 0 km to 1000 km above the Earth's surface, for all conditions and for all methods of modulation, shall not exceed  $-147 \text{ dB(W/(m}^2 \cdot 100 \text{ MHz))}$  for all angles of arrival.

**5.559** In the band 59-64 GHz, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. 5.43).

**5.559B** The use of the frequency band 77.5-78 GHz by the radiolocation service shall be limited to short-range radar for ground-based applications, including automotive radars. The technical characteristics of these radars are provided in the most recent version of Recommendation ITU-R M.2057. The provisions of No. 4.10 do not apply. (WRC-15)

**5.560** In the band 78-79 GHz radars located on space stations may be operated on a primary basis in the Earth exploration-satellite service and in the space research service.

**5.561** In the band 74-76 GHz, stations in the fixed, mobile and broadcasting services shall not cause harmful interference to stations of the fixed-satellite service or stations of the broadcasting-satellite service operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service.

**5.561A** The 81-81.5 GHz band is also allocated to the amateur and amateur-satellite services on a secondary basis.

**5.561B** In Japan, use of the band 84-86 GHz, by the fixed-satellite service (Earth-to-space) is limited to feeder links in the broadcasting-satellite service using the geostationary-satellite orbit.

**5.562** The use of the band 94-94.1 GHz by the Earth exploration-satellite (active) and space research (active) services is limited to spaceborne cloud radars.

**5.562A** In the bands 94-94.1 GHz and 130-134 GHz, transmissions from space stations of the Earth exploration-satellite service (active) that are directed into the main beam of a radio astronomy antenna have the potential to damage some radio astronomy receivers. Space agencies operating the transmitters and the radio astronomy stations concerned should mutually plan their operations so as to avoid such occurrences to the maximum extent possible.

**5.562B** In the bands 105-109.5 GHz, 111.8-114.25 GHz, 155.5-158.5 GHz and 217-226 GHz, the use of this allocation is limited to space-based radio astronomy only.

**5.562C** Use of the band 116-122.25 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, at all altitudes from 0 km to 1000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, shall not exceed  $-148 \text{ dB(W/(m}^2 \cdot \text{MHz))}$  for all angles of arrival.

**5.562D** *Additional allocation:* In Korea (Rep. of), the frequency bands 128-130 GHz, 171-171.6 GHz, 172.2-172.8 GHz and 173.3-174 GHz are also allocated to the radio astronomy service on a primary basis. Radio astronomy stations in Korea (Rep. of) operating in the frequency bands referred to in this footnote shall not claim protection from, or constrain the use and development of, services in other countries operating in accordance with the Radio Regulations. (WRC-15)

**5.562E** The allocation to the Earth exploration-satellite service (active) is limited to the band 133.5-134 GHz.

**5.562F** In the band 155.5-158.5 GHz, the allocation to the Earth exploration-satellite (passive) and space research (passive) services shall terminate on 1 January 2018.

**5.562G** The date of entry into force of the allocation to the fixed and mobile services in the band 155.5-158.5 GHz shall be 1 January 2018.

**5.562H** Use of the bands 174.8-182 GHz and 185-190 GHz by the inter-satellite service is limited to satellites in the geostationary-satellite orbit. The single-entry power flux-density produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, at all altitudes from 0 to 1000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, shall not exceed  $-144 \text{ dB(W/(m}^2 \cdot \text{MHz))}$  for all angles of arrival.

**5.563A** In the bands 200-209 GHz, 235-238 GHz, 250-252 GHz and 265-275 GHz, ground-based passive atmospheric sensing is carried out to monitor atmospheric constituents.

**5.563B** The band 237.9-238 GHz is also allocated to the Earth exploration-satellite service (active) and the space research service (active) for spaceborne cloud radars only.

**5.565** The following frequency bands in the range 275-1000 GHz are identified for use by administrations for passive service applications:

- radio astronomy service: 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz, 453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;
- Earth exploration-satellite service (passive) and space research service (passive): 275-286 GHz, 296-306 GHz, 313-356 GHz, 361-365 GHz, 369-392 GHz, 397-399 GHz, 409-411 GHz, 416-434 GHz, 439-467 GHz, 477-502 GHz, 523-527 GHz, 538-581 GHz, 611-630 GHz, 634-654 GHz, 657-692 GHz, 713-718 GHz, 729-733 GHz, 750-754 GHz, 771-776 GHz, 823-846 GHz, 850-854 GHz, 857-862 GHz, 866-882 GHz, 905-928 GHz, 951-956 GHz, 968-973 GHz and 985-990 GHz.

The use of the range 275-1000 GHz by the passive services does not preclude use of this range by active services. Administrations wishing to make frequencies in the 275-1000 GHz range available for active service applications are urged to take all practicable steps to protect these passive services from harmful interference until the date when the Table of Frequency Allocations is established in the above-mentioned

275-1000 GHz frequency range.

All frequencies in the range 1000-3000 GHz may be used by both active and passive services. (WRC-12)

## United States (US) Footnotes

(These footnotes, each consisting of the letters “US” followed by one or more digits, denote stipulations applicable to both Federal and non-Federal operations and thus appear in both the Federal Table and the non-Federal Table.)

**US1** The bands 2501-2502 kHz, 5003-5005 kHz, 10 003-10 005 kHz, 15 005-15 010 kHz, 19 990-19 995 kHz, 20 005-20 010 kHz, and 25 005-25 010 kHz are also allocated to the space research service on a secondary basis for Federal use. In the event of interference to the reception of the standard frequency and time broadcasts, these space research transmissions are subject to immediate temporary or permanent shutdown.

**US2** In the band 9-490 kHz, electric utilities operate Power Line Carrier (PLC) systems on power transmission lines for communications important to the reliability and security of electric service to the public. These PLC systems operate under the provisions of 47 CFR part 15, or Chapter 8 of the *NTIA Manual*, on an unprotected and non-interference basis with respect to authorized radio users. Notification of intent to place new or revised radio frequency assignments or PLC frequency uses in the band 9-490 kHz is to be made in accordance with the Rules and Regulations of the FCC and NTIA, and users are urged to minimize potential interference to the extent practicable. This footnote does not provide any allocation status to PLC radio frequency uses.

**US8** The use of the frequencies 170.475, 171.425, 171.575, and 172.275 MHz east of the Mississippi River, and 170.425, 170.575, 171.475, 172.225 and 172.375 MHz west of the Mississippi River may be authorized to fixed, land and mobile stations operated by non-Federal forest firefighting agencies. In addition, land stations and mobile stations operated by non-Federal conservation agencies, for mobile relay operation only, may be authorized to use the frequency 172.275 MHz east of the Mississippi River and the frequency 171.475 MHz west of the Mississippi River. The use of any of the foregoing nine frequencies shall be on the condition that no harmful interference will be caused to Government stations.

**US11** On the condition that harmful interference is not caused to present or future Federal stations in the band 162-174 MHz, the frequencies 166.25 MHz and 170.15 MHz may be authorized to non-Federal stations, as follows:

(a) Eligibles in the Public Safety Radio Pool may be authorized to operate in the fixed and land mobile services for locations within 150 miles (241.4 kilometers) of New York City; and

(b) Remote pickup broadcast stations may be authorized to operate in the land mobile service for locations within the conterminous United States, excluding locations within 150 miles of New York City and the Tennessee Valley Authority Area (TVA Area). The TVA Area is bounded on the west by the Mississippi River, on the north by the parallel of latitude 37° 30' N, and on the east and south by that arc of the circle with center at Springfield, IL, and radius equal to the airline distance between Springfield, IL and Montgomery, AL, subtended between the foregoing west and north boundaries.

**US13** The following center frequencies, each with a channel bandwidth not greater than 12.5 kHz, are available for assignment to non-Federal fixed stations for the specific purpose of transmitting hydrological and meteorological data in cooperation with Federal agencies, subject to the condition that harmful interference will not be caused to Federal stations:

Hydro Channels (MHz)			
169.4250	170.2625	171.1000	406.1250
169.4375	170.2750	171.1125	406.1750
169.4500	170.2875	171.1250	412.6625
169.4625	170.3000	171.8250	412.6750
169.4750	170.3125	171.8375	412.6875
169.4875	170.3250	171.8500	412.7125
169.5000	171.0250	171.8625	412.7250
169.5125	171.0375	171.8750	412.7375
169.5250	171.0500	171.8875	412.7625
170.2250	171.0625	171.9000	412.7750
170.2375	171.0750	171.9125	415.1250
170.2500	171.0875	171.9250	415.1750

New assignments on the frequencies 406.125 MHz and 406.175 MHz are to be primarily for paired operations with the frequencies 415.125 MHz and 415.175 MHz, respectively.

**US14** When 500 kHz is being used for distress purposes, ship and coast stations using morse telegraph may use 512 kHz for calling.

**US18** In the bands 9-14 kHz, 90-110 kHz, 190-415 kHz, 510-535 kHz, and 2700-2900 MHz, navigation aids in the U.S. and its insular areas are normally operated by the Federal Government. However, authorizations may be made by the FCC for non-Federal operations in these bands subject to the conclusion of appropriate arrangements between the FCC and the Federal agencies concerned and upon special showing of need for service which the Federal Government is not yet prepared to render.

**US22** The following provisions shall apply to non-Federal use of 68 carrier frequencies in the range 2-8 MHz, which are not coordinated with NTIA:

(a) The frequencies authorized pursuant to 47 CFR 90.264 (Disaster Communications) and 47 CFR 90.266 (Long Distance Communications) are listed in columns 1-2 and columns 3-5, respectively. All stations are restricted to emission designator 2K80J3E, upper sideband transmissions, a maximum transmitter output power of 1 kW PEP, and to the class of station(s) listed in the column heading (*i.e.*, fixed (FX) for all frequencies; base and mobile (FB and ML) for the frequencies in column 1 and 3; itinerant FX for the frequencies in columns 4-5).

(b) *Use, Geographic, and Time Restrictions.* Letter(s) to the right of a frequency indicate that the frequency is available only for the following purpose(s):

– A or I: *Alternate channel or Interstate coordination.*

– C, E, M, or W: For stations located in the Conterminous U.S., *East of 108° West Longitude (WL)*, *West of the Mississippi River*, or *West of 90° WL*.

– D or N: From two hours after local sunrise until two hours before local sunset (*i.e.*, *Day only operations*) or from two hours prior to local sunset until two hours after local sunrise (*i.e.*, *Night only operations*).

Preferred Carrier Frequencies (kHz)				
Disaster Communications		Long Distance Communications		
FX, FB, ML	FX	FX, FB, ML	FX (including itinerant)	
2326 ... I	5135 ... A	2289	5046.6 ... E	7480.1
2411	5140 ... A, I	2292	5052.6 ... E	7483.1
2414	5192 ... I	2395	5055.6 ... E	7486.1 ... E
2419	5195 ... I	2398	5061.6 ... W	7549.1 ... D
2422	7477 ... A	3170	5067.6	7552.1

2439	7480 ... A	4538.6 ... N	5074.6 ... E	7555.1 ... W
2463	7802 ... D	4548.6 ... N	5099.1	7558.1 ... W
2466	7805 ... I	4575	5102.1	7559.1 ... W
2471	7932	4610.5	5313.6	7562.1 ... W
2474	7935 ... C,	4613.5	6800.1 ... N	7697.1
2487	D	4634.5	6803.1	
2511		4637.5	6806.1 ... W	
2535		4647	6855.1 ... N,	
2569			M	
2587			6858.1 ... N	
2801			6861.1 ... W	
2804 ... A			6885.1 ... N	
2812			6888.1 ... N	

NOTE: To determine the assigned frequency, add 1.4 kHz to the carrier frequency. Other emission designators may be authorized within the 2.8 kHz maximum necessary bandwidth pursuant to 47 CFR 90.264 and 90.266.

**US23** In the band 5330.5-5406.4 kHz (60 m band), the assigned frequencies 5332, 5348, 5358.5, 5373, and 5405 kHz are allocated to the amateur service on a secondary basis. Amateur service use of the 60 m band frequencies is restricted to a maximum effective radiated power of 100 W PEP and to the following emission types and designators: phone (2K80J3E), data (2K80J2D), RTTY (60H0J2B), and CW (150HA1A). Amateur operators using the data and RTTY emissions must exercise care to limit the length of transmissions so as to avoid causing harmful interference to Federal stations.

**US25** The use of frequencies in the band 25.85-26.175 MHz may be authorized in any area to non-Federal remote pickup broadcast base and mobile stations on the condition that harmful interference is not caused to stations of the broadcasting service in the band 25.85-26.1 MHz and to stations of the maritime mobile service in the band 26.1-26.175 MHz. Frequencies within the band 26.1-26.175 MHz may also be assigned for use by low power auxiliary stations.

**US26** The bands 117.975-121.4125 MHz, 123.5875-128.8125 MHz and 132.0125-136.0 MHz are for air traffic control communications.

**US28** The band 121.5875-121.9375 MHz is for use by aeronautical utility land and mobile stations, and for air traffic control communications.

**US30** The band 121.9375-123.0875 MHz is available to FAA aircraft for communications pursuant to flight inspection functions in accordance with the Federal Aviation Act of 1958.

**US31** The frequencies 122.700, 122.725, 122.750, 122.800, 122.950, 122.975, 123.000, 123.050 and 123.075 MHz may be assigned to aeronautical advisory stations. In addition, at landing areas having a part-time or no airdrome control tower or FAA flight service station, these frequencies may be assigned on a secondary non-interference basis to aeronautical utility mobile stations, and may be used by FAA ground vehicles for safety related communications during inspections conducted at such landing areas.

The frequencies 122.850, 122.900 and 122.925 MHz may be assigned to aeronautical multicom stations. In addition, 122.850 MHz may be assigned on a secondary noninterference basis to aeronautical utility mobile stations. In case of 122.925 MHz, US213 applies.

Air carrier aircraft stations may use 122.000 and 122.050 MHz for communication with aeronautical stations of the Federal Aviation Administration and 122.700, 122.800, 122.900 and 123.000 MHz for communications with aeronautical stations pertaining to safety of flight with and in the vicinity of landing areas not served by a control tower.

Frequencies in the band 121.9375-122.6875 MHz may be used by aeronautical stations of the Federal

Aviation Administration for communication with aircraft stations.

**US32** Except for the frequencies 123.3 and 123.5 MHz, which are not authorized for Federal use, the band 123.1125-123.5875 MHz is available for FAA communications incident to flight test and inspection activities pertinent to aircraft and facility certification on a secondary basis.

**US33** The band 123.1125-123.5875 MHz is for use by flight test and aviation instructional stations. The frequency 121.950 MHz is available for aviation instructional stations.

**US36** In Hawaii, the bands 120.647-120.653 MHz and 127.047-127.053 MHz are also allocated to the aeronautical mobile service on a primary basis for non-Federal aircraft air-to-air communications on 120.65 MHz (Maui) and 127.05 MHz (Hawaii and Kauai) as specified in 47 CFR 87.187.

**US41** In the band 2450-2500 MHz, the Federal radiolocation service is permitted on condition that harmful interference is not caused to non-Federal services.

**US44** In the band 2900-3100 MHz, the non-Federal radiolocation service may be authorized on the condition that no harmful interference is caused to Federal services.

**US49** In the band 5460-5470 MHz, the non-Federal radiolocation service may be authorized on the condition that it does not cause harmful interference to the aeronautical or maritime radionavigation services or to the Federal radiolocation service.

**US50** In the band 5470-5650 MHz, the radiolocation service may be authorized for non-Federal use on the condition that harmful interference is not caused to the maritime radionavigation service or to the Federal radiolocation service.

**US52** In the VHF maritime mobile band (156-162 MHz), the following provisions shall apply:

(a) Except as provided for below, the use of the bands 161.9625-161.9875 MHz (AIS 1 with center frequency 161.975 MHz) and 162.0125-162.0375 MHz (AIS 2 with center frequency 162.025 MHz) by the maritime mobile and mobile-satellite (Earth-to-space) services is restricted to Automatic Identification Systems (AIS). The use of these bands by the aeronautical mobile (OR) service is restricted to AIS emissions from search and rescue aircraft operations. Frequencies in the AIS 1 band may continue to be used by non-Federal base, fixed, and land mobile stations until March 2, 2024.

(b) Except as provided for below, the use of the bands 156.7625-156.7875 MHz (AIS 3 with center frequency 156.775 MHz) and 156.8125-156.8375 MHz (AIS 4 with center frequency 156.825 MHz) by the mobile-satellite service (Earth-to-space) is restricted to the reception of long-range AIS broadcast messages from ships (Message 27; see most recent version of Recommendation ITU-R M.1371). The frequencies 156.775 MHz and 156.825 MHz may continue to be used by non-Federal ship and coast stations for navigation-related port operations or ship movement until August 26, 2019.

(c) The frequency 156.3 MHz may also be used by aircraft stations for the purpose of search and rescue operations and other safety-related communication.

(d) Federal stations in the maritime mobile service may also be authorized as follows: (1) Vessel traffic services under the control of the U.S. Coast Guard on a simplex basis by coast and ship stations on the frequencies 156.25, 156.55, 156.6 and 156.7 MHz; (2) Inter-ship use of the frequency 156.3 MHz on a simplex basis; (3) Navigational bridge-to-bridge and navigational communications on a simplex basis by coast and ship stations on the frequencies 156.375 and 156.65 MHz; (4) Port operations use on a simplex basis by coast and ship stations on the frequencies 156.6 and 156.7 MHz; (5) Environmental communications on the frequency 156.75 MHz in accordance with the national plan; and (6) Duplex port operations use of the frequencies 157 MHz for ship stations and 161.6 MHz for coast stations.

**US53** In view of the fact that the band 13.25-13.4 GHz is allocated to doppler navigation aids, Federal and non-Federal airborne doppler radars in the aeronautical radionavigation service are permitted in the band 8750-8850 MHz only on the condition that they must accept any interference that may be experienced from stations in the radiolocation service in the band 8500-10000 MHz.

**US55** In the bands 162.0375-173.2 MHz and 406.1-420 MHz, the FCC may authorize public safety applicants to use the 40 Federal Interoperability Channels that are designated for joint Federal/non-Federal operations for law enforcement, public safety, emergency response and disaster response in Section 4.3.16 of the NTIA Manual, subject to the condition that these non-Federal mobile (including portable) interoperability communications shall conform to the national plans specified therein, and in particular, shall not cause harmful interference to Federal stations. The procedure for authorizing such use is set forth in 47 CFR 90.25.

**US59** The band 10.5-10.55 GHz is restricted to systems using type NON (AO) emission with a power not to exceed 40 watts into the antenna.

**US64** (a) In the band 401-406 MHz, the mobile, except aeronautical mobile, service is allocated on a secondary basis and is limited to, with the exception of military tactical mobile stations, Medical Device Radiocommunication Service (MedRadio) operations. MedRadio stations are authorized by rule on the condition that harmful interference is not caused to stations in the meteorological aids, meteorological-satellite, and Earth exploration-satellite services, and that MedRadio stations accept interference from stations in the meteorological aids, meteorological-satellite, and Earth exploration-satellite services.

(b) The bands 413-419 MHz, 426-432 MHz, 438-444 MHz, and 451-457 MHz are also allocated on a secondary basis to the mobile, except aeronautical mobile, service. The use of this allocation is limited to MedRadio operations. MedRadio stations are authorized by rule and operate in accordance with 47 CFR part 95.

**US65** The use of the band 5460-5650 MHz by the maritime radionavigation service is limited to shipborne radars.

**US67** The use of the band 9300-9500 MHz by the meteorological aids service is limited to ground-based radars. Radiolocation installations will be coordinated with the meteorological aids service and, insofar as practicable, will be adjusted to meet the requirements of the meteorological aids service.

**US69** In the band 31.8-33.4 GHz, ground-based radionavigation aids are not permitted except where they operate in cooperation with airborne or shipborne radionavigation devices.

**US70** The meteorological aids service allocation in the band 400.15-406.0 MHz does not preclude the operation therein of associated ground transmitters.

**US71** In the band 9300-9320 MHz, low-powered maritime radionavigation stations shall be protected from harmful interference caused by the operation of land-based equipment.

**US73** The frequencies 150.775, 150.79, 152.0075, and 163.25 MHz, and the bands 462.94-463.19675 and 467.94-468.19675 MHz shall be authorized for the purpose of delivering or rendering medical services to individuals (medical radiocommunication systems), and shall be authorized on a primary basis for Federal and non-Federal use. The frequency 152.0075 MHz may also be used for the purpose of conducting public safety radio communications that include, but are not limited to, the delivering or rendering of medical services to individuals.

(a) The use of the frequencies 150.775 and 150.79 MHz is restricted to mobile stations operating with a maximum e.r.p. of 100 watts. Airborne operations are prohibited.

(b) The use of the frequencies 152.0075 and 163.25 MHz is restricted to base stations that are authorized only for one-way paging communications to mobile receivers. Transmissions for the purpose of activating or controlling remote objects on these frequencies shall not be authorized.

(c) Non-Federal licensees in the Public Safety Radio Pool holding a valid authorization on May 27, 2005, to operate on the frequencies 150.7825 and 150.7975 MHz may, upon proper renewal application, continue to be authorized for such operation; provided that harmful interference is not caused to present or future Federal stations in the band 150.05-150.8 MHz and, should harmful interference result, that the interfering non-Federal operation shall immediately terminate.

**US74** In the bands 25.55-25.67, 73-74.6, 406.1-410, 608-614, 1400-1427, 1660.5-1670, 2690-2700, and 4990-5000 MHz, and in the bands 10.68-10.7, 15.35-15.4, 23.6-24.0, 31.3-31.5, 86-92, 100-102, 109.5-111.8, 114.25-116, 148.5-151.5, 164-167, 200-209, and 250-252 GHz, the radio astronomy service shall be protected from unwanted emissions only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates. Radio astronomy observations in these bands are performed at the locations listed in US385.

**US79** In the bands 1390-1400 MHz and 1427-1432 MHz, the following provisions shall apply:

- (a) Airborne and space-to-Earth operations are prohibited.
- (b) Federal operations (except for devices authorized by the FCC for the Wireless Medical Telemetry Service) are on a non-interference basis to non-Federal operations and shall not constrain implementation of non-Federal operations.

**US80** Federal stations may use the frequency 122.9 MHz subject to the following conditions: (a) All operations by Federal stations shall be restricted to the purpose for which the frequency is authorized to non-Federal stations, and shall be in accordance with the appropriate provisions of the Commission's Rules and Regulations, Part 87, Aviation Services; (b) Use of the frequency is required for coordination of activities with Commission licensees operating on this frequency; and (c) Federal stations will not be authorized for operation at fixed locations.

**US81** The band 38-38.25 MHz is used by both Federal and non-Federal radio astronomy observatories. No new fixed or mobile assignments are to be made and Federal stations in the band 38-38.25 MHz will be moved to other bands on a case-by-case basis, as required, to protect radio astronomy observations from harmful interference. As an exception, however, low powered military transportable and mobile stations used for tactical and training purposes will continue to use the band. To the extent practicable, the latter operations will be adjusted to relieve such interference as may be caused to radio astronomy observations. In the event of harmful interference from such local operations, radio astronomy observatories may contact local military commands directly, with a view to effecting relief. A list of military commands, areas of coordination, and points of contact for purposes of relieving interference may be obtained upon request from the Office of Engineering and Technology, FCC, Washington, DC 20554.

**US82** In the bands 4146-4152 kHz, 6224-6233 kHz, 8294-8300 kHz, 12 353-12 368 kHz, 16 528-16 549 kHz, 18 825-18 846 kHz, 22 159-22 180 kHz, and 25 100-25 121 kHz, the assignable frequencies may be authorized on a shared non-priority basis to Federal and non-Federal ship and coast stations (SSB telephony, with peak envelope power not to exceed 1 kW).

**US83** In the 1432-1435 MHz band, Federal stations in the fixed and mobile services may operate indefinitely on a primary basis at the 22 sites listed in the table below. The first 21 sites are in the United States and the last site is in Guam (GU). All other Federal stations in the fixed and mobile services shall operate in the band 1432-1435 MHz on a primary basis until reaccommodated in accordance with the National Defense Authorization Act of 1999.

State	Site	North	West	Radius
AK	Fort Greely	63° 47'	145° 52'	80
AL	Redstone Arsenal	34° 35'	086° 35'	80
AZ	Fort Huachuca	31° 33'	110° 18'	80
AZ	Yuma Proving Ground	32° 29'	114° 20'	160
CA	China Lake/Edwards AFB	35° 29'	117° 16'	100
CA	Lemoore	36° 20'	119° 57'	120
FL	Eglin AFB/Ft Rucker, AL	30° 28'	086° 31'	140
FL	NAS Cecil Field	30° 13'	081° 52'	160
MD	Patuxent River	38° 17'	076° 24'	70



ME	Naval Space Operations Center	44° 24'	068° 01'	80
MI	Alpena Range	44° 23'	083° 20'	80
MS	Camp Shelby	31° 20'	089° 18'	80
NC	MCAS Cherry Point	34° 54'	076° 53'	100
NM	White Sands Missile Range/Holloman AFB	32° 11'	106° 20'	160
NV	NAS Fallon	39° 30'	118° 46'	100
NV	Nevada Test and Training Range (NTTR)	37° 29'	114° 14'	130
SC	Beaufort MCAS	32° 26'	080° 40'	160
SC	Savannah River	33° 15'	081° 39'	3
UT	Utah Test & Training Range/Dugway Proving Ground, Hill AFB	40° 57'	113° 05'	160
VA	NAS Oceana	36° 49'	076° 01'	100
WA	NAS Whidbey Island	48° 21'	122° 39'	70
GU	NCTAMS	13° 35'	144° 51'	80

NOTE: The coordinates (North latitude and West longitude) are listed under the headings North and West. The Guam entry under the West heading is actually 144° 51' East longitude. The operating radii in kilometers are listed under the heading Radius.

**US84** In the bands 941.5-944 MHz and 1435-1525 MHz, low power auxiliary stations may be authorized on a secondary basis, subject to the terms and conditions set forth in 47 CFR part 74, subpart H.

**US85** Differential-Global-Positioning-System (DGPS) Stations, limited to ground-based transmitters, may be authorized on a primary basis in the band 1559-1610 MHz for the specific purpose of transmitting DGPS information intended for aircraft navigation.

**US87** The band 449.75-450.25 MHz may be used by Federal and non-Federal stations for space telecommand (Earth-to-space) at specific locations, subject to such conditions as may be applied on a case-by-case basis. Operators shall take all practical steps to keep the carrier frequency close to 450 MHz.

**US88** In the bands 1675-1695 MHz and 1695-1710 MHz, the following provisions shall apply:

(a) Non-Federal use of the band 1695-1710 MHz by the fixed and mobile except aeronautical mobile services is restricted to stations in the Advanced Wireless Service (AWS). Base stations that enable AWS mobile and portable stations to operate in the band 1695-1710 MHz must be successfully coordinated prior to operation as follows: (i) all base stations within the 27 protection zones listed in paragraph (b) that enable mobiles to operate at a maximum e.i.r.p. of 20 dBm, and (ii) nationwide for base stations that enable mobiles to operate with a maximum e.i.r.p. greater than 20 dBm, up to a maximum e.i.r.p. of 30 dBm, unless otherwise specified by Commission rule, order, or notice.

(b) Forty-seven Federal earth stations located within the protection zones listed below operate on a co-equal, primary basis with AWS operations. All other Federal earth stations operate on a secondary basis.

(1) Protection zones for Federal earth stations receiving in the band 1695-1710 MHz:

State	Location	Latitude	Longitude	Radius (km)
AK	Barrow .....	71° 19' 22"	156° 36' 41"	..... 35
AK	Elmendorf AFB .....	61° 14' 08"	149° 55' 31"	..... 98
AK	Fairbanks .....	64° 58' 22"	147° 30' 02"	..... 20
AZ	Yuma .....	32° 39' 24"	114° 36' 22"	..... 95
CA	Monterey .....	36° 35' 34"	121° 51' 20"	..... 76
CA	Twenty-Nine Palms...	34° 17' 46"	116° 09' 44"	..... 80
FL	Miami .....	25° 44' 05"	080° 09' 45"	..... 51
HI	Hickam AFB .....	21° 19' 18"	157° 57' 30"	..... 28
MD	Suitland .....	38° 51' 07"	076° 56' 12"	..... 98

MS	Stennis Space Center	30° 21' 23"	089° 36' 41"	..... 57
SD	Sioux Falls .....	43° 44' 09"	096° 37' 33"	..... 42
VA	Wallops Island .....	37° 56' 45"	075° 27' 45"	..... 30
GU	Andersen AFB .....	13° 34' 52"	144° 55' 28"	..... 42

(2) Protection zones for Federal earth stations receiving in the band 1675-1695 MHz:

State	Location	Latitude	Longitude	Radius (km)
CA	Sacramento .....	38° 35' 50"	121° 32' 34"	..... 55
CO	Boulder .....	39° 59' 26"	105° 15' 51"	..... 02
ID	Boise .....	43° 35' 42"	116° 13' 49"	..... 39
IL	Rock Island .....	41° 31' 04"	090° 33' 46"	..... 19
MO	Kansas City .....	39° 16' 40"	094° 39' 44"	..... 40
MO	St. Louis .....	38° 35' 26"	090° 12' 25"	..... 34
MS	Columbus Lake .....	33° 32' 04"	088° 30' 06"	..... 03
MS	Vicksburg .....	32° 20' 47"	090° 50' 10"	..... 16
NE	Omaha .....	41° 20' 56"	095° 57' 34"	..... 30
OH	Cincinnati .....	39° 06' 10"	084° 30' 35"	..... 32
OK	Norman .....	35° 10' 52"	097° 26' 21"	..... 03
TN	Knoxville .....	35° 57' 58"	083° 55' 13"	..... 50
WV	Fairmont .....	39° 26' 02"	080° 11' 33"	..... 04
PR	Guaynabo .....	18° 25' 26"	066° 06' 50"	..... 48

NOTE: The coordinates are specified in the conventional manner (North latitude, West longitude), except that the Guam (GU) entry is specified in terms of East longitude.

**US90** In the band 2025-2110 MHz, the power flux-density at the Earth's surface produced by emissions from a space station in the space operation, Earth exploration-satellite, or space research service that is transmitting in the space-to-space direction, for all conditions and all methods of modulation, shall not exceed the following values in any 4 kHz sub-band:

- (a)  $-154 \text{ dBW/m}^2$  for angles of arrival above the horizontal plane ( $\delta$ ) of  $0^\circ$  to  $5^\circ$ ,
- (b)  $-154 + 0.5(\delta-5) \text{ dBW/m}^2$  for  $\delta$  of  $5^\circ$  to  $25^\circ$ , and
- (c)  $-144 \text{ dBW/m}^2$  for  $\delta$  of  $25^\circ$  to  $90^\circ$ .

**US91** In the band 1755-1780 MHz, the following provisions shall apply:

(a) Non-Federal use of the band 1755-1780 MHz by the fixed and mobile services is restricted to stations in the Advanced Wireless Service (AWS). Base stations that enable AWS mobile and portable stations to operate in the band 1755-1780 MHz must be successfully coordinated on a nationwide basis prior to operation, unless otherwise specified by Commission rule, order, or notice.

(b) In the band 1755-1780 MHz, the Federal systems listed below operate on a co-equal, primary basis with AWS stations. All other Federal stations in the fixed and mobile services identified in an approved Transition Plan will operate on a primary basis until reaccommodated in accordance with 47 CFR part 301.

(1) Joint Tactical Radio Systems (JTRS) may operate indefinitely at the following locations:

State	Training area	Latitude	Longitude
AZ	Yuma Proving Ground .....	33° 12' 14"	114° 13' 47"
CA	Fort Irwin .....	35° 23' 19"	116° 37' 43"
LA	Fort Polk .....	31° 08' 38"	093° 06' 52"
NC	Fort Bragg (including Camp MacKall)....	35° 09' 04"	078° 59' 13"
NM	White Sands Missile Range.....	32° 52' 50"	106° 23' 10"
TX	Fort Hood .....	31° 13' 50"	097° 45' 23"

(2) Air combat training system (ACTS) stations may operate on two frequencies within two geographic zones that are defined by the following coordinates:

Geographic Zone	Latitude	Longitude
Polygon 1	41° 52' 00"	117° 49' 00"
	42° 00' 00"	115° 05' 00"
	43° 31' 13"	115° 47' 18"
Polygon 2	47° 29' 00"	111° 22' 00"
	48° 13' 00"	110° 00' 00"
	47° 30' 00"	107° 00' 00"
	44° 11' 00"	103° 06' 00"

NOTE: ACTS transmitters may cause interference to AWS base stations between separation distances of 285 km (minimum) and 415 km (maximum).

(3) In the sub-band 1761-1780 MHz, Federal earth stations in the space operation service (Earth-to-space) may transmit at the following 25 sites and non-Federal base stations must accept harmful interference caused by the operation of these earth stations:

State	Site	Latitude	Longitude
AK	Fairbanks .....	64° 58' 20"	147° 30' 59"
CA	Camp Parks .....	37° 43' 51"	121° 52' 50"
CA	Huntington Beach .....	33° 44' 50"	118° 02' 04"
CA	Laguna Peak .....	34° 06' 31"	119° 03' 53"
CA	Monterey .....	36° 35' 42"	121° 52' 28"
CA	Sacramento .....	38° 39' 59"	121° 23' 33"
CA	Vandenberg AFB .....	34° 49' 23"	120° 30' 07"
CO	Buckley .....	39° 42' 55"	104° 46' 29"
CO	Schriever AFB .....	38° 48' 22"	104° 31' 41"
FL	Cape Canaveral AFS .....	28° 29' 09"	080° 34' 33"
FL	Cape GA, CCAFB .....	28° 29' 03"	080° 34' 21"
FL	JIATF-S Key West .....	24° 32' 36"	081° 48' 17"
HI	Kaena Point, Oahu .....	21° 33' 43"	158° 14' 31"
MD	Annapolis .....	38° 59' 27"	076° 29' 25"
MD	Blossom Point .....	38° 25' 53"	077° 05' 06"
MD	Patuxent River NAS .....	38° 16' 28"	076° 24' 45"
ME	Prospect Harbor .....	44° 24' 16"	068° 00' 46"
NC	Ft Bragg .....	35° 09' 04"	078° 59' 13"
NH	New Boston AFS .....	42° 56' 46"	071° 37' 44"
NM	Kirtland AFB .....	34° 59' 06"	106° 30' 28"
TX	Ft Hood .....	31° 08' 57"	097° 46' 12"
VA	Fort Belvoir .....	38° 44' 04"	077° 09' 12"
WA	Joint Base Lewis-McChord	47° 06' 11"	122° 33' 11"
GU	Andersen AFB .....	13° 36' 54"	144° 51' 22"
GU	NAVSOC Det. Charlie .....	13° 34' 58"	144° 50' 32"

NOTE: The coordinates are specified in the conventional manner (North latitude, West longitude), except that the Guam (GU) entries are specified in terms of East longitude. Use at Cape Canaveral AFS is restricted to launch support only. If required, successfully coordinated with all affected AWS licensees, and authorized by NTIA, reasonable modifications of these grandfathered Federal systems beyond their current authorizations or the addition of new earth station locations may be permitted. The details of the coordination must be filed with NTIA and FCC.

(c) In the band 1755-1780 MHz, the military services may conduct Electronic Warfare (EW) operations

on Federal ranges and within associated airspace on a non-interference basis with respect to non-Federal AWS operations and shall not constrain implementation of non-Federal AWS operations. This use is restricted to Research, Development, Test and Evaluation (RDT&E), training, and Large Force Exercise (LFE) operations.

**US92** In the band 2025-2110 MHz, Federal use of the co-primary fixed and mobile services is restricted to the military services and the following provisions apply:

(a) Federal use shall not cause harmful interference to, nor constrain the deployment and use of the band by, the Television Broadcast Auxiliary Service, the Cable Television Relay Service, or the Local Television Transmission Service. To facilitate compatible operations, coordination is required in accordance with a Memorandum of Understanding between Federal and non-Federal fixed and mobile operations. Non-Federal licensees shall make all reasonable efforts to accommodate military mobile and fixed operations; however, the use of the band 2025-2110 MHz by the non-Federal fixed and mobile services has priority over military fixed and mobile operations.

(b) Military stations should, to the extent practicable, employ frequency agile technologies and techniques, including the capability to tune to other frequencies and the use of a modular retrofit capability, to facilitate sharing of this band with incumbent Federal and non-Federal operations.

**US93** In the conterminous United States, the frequency 108.0 MHz may be authorized for use by VOR test facilities, the operation of which is not essential for the safety of life or property, subject to the condition that no interference is caused to the reception of FM broadcasting stations operating in the band 88-108 MHz. In the event that such interference does occur, the licensee or other agency authorized to operate the facility shall discontinue operation on 108 MHz and shall not resume operation until the interference has been eliminated or the complaint otherwise satisfied. VOR test facilities operating on 108 MHz will not be protected against interference caused by FM broadcasting stations operating in the band 88-108 MHz nor shall the authorization of a VOR test facility on 108 MHz preclude the Commission from authorizing additional FM broadcasting stations.

**US96** The band 2200-2290 MHz is allocated to the space operation service (space-to-Earth) on a secondary basis for non-Federal use subject to the following conditions. Non-Federal stations shall be:

(a) restricted to transmissions from the launch vehicle in the sub-bands 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz (necessary bandwidth shall be contained within these ranges);

(b) restricted to use for pre-launch testing and space launch operations, except as provided under US303; and

(c) subject to coordination with NTIA prior to each launch.

**US97** The following provisions shall apply in the band 2305-2320 MHz:

(a) In the sub-band 2305-2310 MHz, space-to-Earth operations are prohibited.

(b) Within 145 km of Goldstone, CA (35° 25' 33" N, 116° 53' 23" W), Wireless Communications Service (WCS) licensees operating base stations in the band 2305-2320 MHz shall, prior to operation of those base stations, achieve a mutually satisfactory coordination agreement with the National Aeronautics and Space Administration (NASA).

NOTE: NASA operates a deep space facility in Goldstone in the band 2290-2300 MHz.

**US99** In the band 1668.4-1670 MHz, the meteorological aids service (radiosonde) will avoid operations to the maximum extent practicable. Whenever it is necessary to operate radiosondes in the band 1668.4-1670 MHz within the United States, notification of the operations shall be sent as far in advance as possible to the National Science Foundation, Division of Astronomical Sciences, Electromagnetic Spectrum Management Unit, 2415 Eisenhower Avenue, Alexandria, VA 22314; Email: [esm@nsf.gov](mailto:esm@nsf.gov).

**US100** The following provisions shall apply to the bands 2310-2320 MHz and 2345-2360 MHz:

(a) The bands 2310-2320 and 2345-2360 MHz are available for Federal aeronautical telemetering and associated telecommand operations for flight testing of manned or unmanned aircraft, missiles, or major

components thereof, on a secondary basis to the Wireless Communications Service (WCS). The frequencies 2312.5 MHz and 2352.5 MHz are shared on a co-equal basis by Federal stations for telemetering and associated telecommand operations of expendable and reusable launch vehicles, irrespective of whether such operations involve flight testing. Other Federal mobile telemetering uses may be provided in the bands 2310-2320 and 2345-2360 MHz on a non-interference basis to all other uses authorized pursuant to this footnote.

(b) The band 2345-2360 MHz is available for non-Federal aeronautical telemetering and associated telecommand operations for flight testing of manned or unmanned aircraft, missiles, or major components thereof, on a secondary basis to the WCS until January 1, 2020. The use of this allocation is restricted to non-Federal licensees in the Aeronautical and Fixed Radio Service holding a valid authorization on April 23, 2015.

**US101** The band 2360-2400 MHz is also allocated on a secondary basis to the mobile, except aeronautical mobile, service. The use of this allocation is limited to MedRadio operations. MedRadio stations are authorized by rule and operate in accordance with 47 CFR part 95.

**US102** In Alaska only, the frequency 122.1 MHz may also be used for air carrier air traffic control purposes at locations where other frequencies are not available to air carrier aircraft stations for air traffic control.

**US103** In the band 3300-3550 MHz, non-Federal stations in the radiolocation service that were licensed (or licensed pursuant to applications accepted for filing) before February 22, 2019 may continue to operate on a secondary basis until 180 days after the issuance of the first flexible-use licenses in the 3.45 GHz Service. No new assignments shall be made. In the band 3300-3500 MHz, stations in the amateur service may continue to operate on a secondary basis until new flexible-use licenses are issued for operation in the band in which they operate. Amateur operations between 3450 MHz and 3500 MHz must cease within 90 days of the public notice announcing the close of the auction for the 3.45 GHz Service. Stations in the amateur service may continue to operate in the band 3300-3450 MHz on a secondary basis while the band's future uses are finalized, but stations in the amateur service may be required to cease operations in the band 3300-3450 MHz at any time if the amateur service causes harmful interference to flexible-use operations.

**US104** In the band 90-110 kHz, the LORAN radionavigation system has priority in the United States and its insular areas. Radiolocation land stations making use of LORAN type equipment may be authorized to both Federal and non-Federal licensees on a secondary basis for offshore radiolocation activities only at specific locations and subject to such technical and operational conditions (*e.g.*, power, emission, pulse rate and phase code, hours of operation), including on-the-air testing, as may be required on a case-by-case basis to ensure protection of the LORAN radionavigation system from harmful interference and to ensure mutual compatibility among radiolocation operators. Such authorizations to stations in the radiolocation service are further subject to showing of need for service which is not currently provided and which the Federal Government is not yet prepared to render by way of the radionavigation service.

**US105** In the band 3550-3650 MHz, non-Federal stations in the radiolocation service that were licensed or applied for prior to July 23, 2015 may continue to operate on a secondary basis until the end of the equipment's useful lifetime.

**US107** In the band 3600-3650 MHz, the following provisions shall apply to earth stations in the fixed-satellite service (space-to-Earth):

(a) Earth stations authorized prior to, or granted as a result of an application filed prior to, July 23, 2015 and constructed within 12 months of initial authorization may continue to operate on a primary basis. Applications for modifications to such earth station facilities filed after July 23, 2015 shall not be accepted, except for changes in polarization, antenna orientation, or ownership; and increases in antenna size for interference mitigation purposes.

(b) The assignment of frequencies to new earth stations after July 23, 2015 shall be authorized on a secondary basis.

**US108** In the band 10-10.5 GHz, survey operations, using transmitters with a peak power not to exceed five watts into the antenna, may be authorized for Federal and non-Federal use on a secondary basis to other Federal radiolocation operations.

**US109** The band 3650-3700 MHz is also allocated to the Federal radiolocation service on a primary basis at the following sites: St. Inigoes, MD (38° 10' N, 76° 23' W); Pascagoula, MS (30° 22' N, 88° 29' W); and Pensacola, FL (30° 21' 28" N, 87° 16' 26" W). The FCC shall coordinate all non-Federal operations authorized under 47 CFR Part 90 within 80 km of these sites with NTIA on a case-by-case basis. For stations in the Citizens Broadband Radio Service these sites shall be protected consistent with the procedures set forth in 47 CFR 96.15(b) and 96.67.

**US110** In the band 9200-9300 MHz, the use of the radiolocation service by non-Federal licensees may be authorized on the condition that harmful interference is not caused to the maritime radionavigation service or to the Federal radiolocation service.

**US111** In the band 5091-5150 MHz, aeronautical mobile telemetry operations for flight testing are conducted at the following locations. Flight testing at additional locations may be authorized on a case-by-case basis.

Location	Test Sites	Lat. (N)	Long. (W)
Gulf Area Ranges Complex (GARC)	Eglin AFB, Tyndall AFB, FL; Gulfport ANG Range, MS; Ft. Rucker, Redstone, NASA Marshall Space Flight Center, AL	30° 28'	86° 31'
Utah Ranges Complex (URC)	Dugway PG; Utah Test & Training Range (Hill AFB), UT	40° 57'	113° 05'
Western Ranges Complex (WRC)	Pacific Missile Range; Vandenberg AFB, China Lake NAWS, Pt. Mugu NAWS, Edwards AFB, Thermal, Nellis AFB, Ft. Irwin, NASA Dryden Flight Research Center, Victorville, CA	35° 29'	117° 16'
Southwest Ranges Complex (SRC)	Ft. Huachuca, Tucson, Phoenix, Mesa, Yuma, AZ	31° 33'	110° 18'
Mid-Atlantic Ranges Complex (MARC)	Patuxent River, Aberdeen PG, NASA Langley Research Center, NASA Wallops Flight Facility, MD	38° 17'	76° 24'
New Mexico Ranges Complex (NMRC)	White Sands Missile Range, Holloman AFB, Albuquerque, Roswell, NM; Amarillo, TX	32° 11'	106° 20'
Colorado Ranges Complex (CoRC)	Alamosa, Leadville, CO	37° 26'	105° 52'
Texas Ranges Complex (TRC)	Dallas/Ft. Worth, Greenville, Waco, Johnson Space Flight Center/Ellington Field, TX	32° 53'	97° 02'
Cape Ranges Complex (CRC)	Cape Canaveral, Palm Beach-Dade, FL	28° 33'	80° 34'
Northwest Range Complex (NWRC)	Seattle, Everett, Spokane, Moses Lake, WA; Klamath Falls, Eugene, OR	47° 32'	122° 18'
St. Louis	St Louis, MO	38° 45'	90° 22'
Wichita	Wichita, KS	37° 40'	97° 26'
Marietta	Marietta, GA	33° 54'	84° 31'
Glasgow	Glasgow, MT	48° 25'	106° 32'
Wilmington/Ridley	Wilmington, DE/Ridley, PA	39° 49'	75° 26'
San Francisco Bay Area (SFBA)	NASA Ames Research Center, CA	37° 25'	122° 03'
Charleston	Charleston, SC	32° 52'	80° 02'

**US112** The frequency 123.1 MHz is for search and rescue communications. This frequency may be assigned for air traffic control communications at special aeronautical events on the condition that no harmful interference is caused to search and rescue communications during any period of search and rescue operations in the locale involved.

**US113** Radio astronomy observations of the formaldehyde line frequencies 4825-4835 MHz and 14.47-14.5 GHz may be made at certain radio astronomy observatories as indicated below:

BANDS TO BE OBSERVED		
4 GHz	14 GHz	Observatory
X	.....	National Astronomy and Ionosphere Center (NAIC), Arecibo, PR
X	X	National Radio Astronomy Observatory (NRAO), Green Bank, WV
X	X	NRAO, Socorro, NM
X	.....	Allen Telescope Array (ATA), Hat Creek, CA
X	X	Owens Valley Radio Observatory (OVRO), Big Pine, CA
X	X	NRAO's ten Very Long Baseline Array (VLBA) stations (see US131)
X	X	University of Michigan Radio Astronomy Observatory, Stinchfield Woods, MI
X	.....	Pisgah Astronomical Research Institute, Rosman, NC

Every practicable effort will be made to avoid the assignment of frequencies to stations in the fixed or mobile services in these bands. Should such assignments result in harmful interference to these observations, the situation will be remedied to the extent practicable.

**US115** In the bands 5000-5010 MHz and 5010-5030 MHz, the following provisions shall apply:

(a) In the band 5000-5010 MHz, systems in the aeronautical mobile (R) service (AM(R)S) are limited to surface applications at airports that operate in accordance with international aeronautical standards (*i.e.*, AeroMACS).

(b) The band 5010-5030 MHz is also allocated on a primary basis to the AM(R)S, limited to surface applications at airports that operate in accordance with international aeronautical standards. In making assignments for this band, attempts shall first be made to satisfy the AM(R)S requirements in the bands 5000-5010 MHz and 5091-5150 MHz. AM(R)S systems used in the band 5010-5030 MHz shall be designed and implemented to be capable of operational modification if receiving harmful interference from the radionavigation-satellite service. Finally, notwithstanding Radio Regulation No. 4.10, stations in the AM(R)S operating in this band shall be designed and implemented to be capable of operational modification to reduce throughput and/or preclude the use of specific frequencies in order to ensure protection of radionavigation-satellite service systems operating in this band.

(c) Aeronautical fixed communications that are an integral part of the AeroMACS system in the bands 5000-5010 MHz and 5010-5030 MHz are also authorized on a primary basis.

**US116** In the bands 890-902 MHz and 935-941 MHz, no new assignments are to be made to Federal radio stations after July 10, 1970, except on case-by-case basis to experimental stations. Federal assignments existing prior to July 10, 1970, shall be on a secondary basis to stations in the non-Federal land mobile service and shall be subject to adjustment or removal from the bands 890-902 MHz, 928-932 MHz, and 935-941 MHz at the request of the FCC.

**US117** In the band 406.1-410 MHz, the following provisions shall apply:

(a) Stations in the fixed and mobile services are limited to a transmitter output power of 125 watts, and new authorizations for stations, other than mobile stations, are subject to prior coordination by the applicant in the following areas:

(1) Within Puerto Rico and the U.S. Virgin Islands, contact Spectrum Manager, Arecibo Observatory, HC3 Box 53995, Arecibo, PR 00612. Phone: 787-878-2612, Fax: 787-878-1861, E-mail: [prcz@naic.edu](mailto:prcz@naic.edu).

(2) Within 350 km of the Very Large Array (34° 04' 44" N, 107° 37' 06" W), contact Spectrum Manager, National Radio Astronomy Observatory, P.O. Box O, 1003 Lopezville Road, Socorro, NM 87801. Phone:

505-835-7000, Fax: 505-835-7027, E-mail: [nrao-rfi@nrao.edu](mailto:nrao-rfi@nrao.edu).

(3) Within 10 km of the Table Mountain Observatory (40° 08' 02" N, 105° 14' 40" W) and for operations only within the sub-band 407-409 MHz, contact Radio Frequency Manager, Department of Commerce, 325 Broadway, Boulder, CO 80305. Phone: 303-497-4619, Fax: 303-497-6982, E-mail: [frequencymanager@its.bldrdoc.gov](mailto:frequencymanager@its.bldrdoc.gov).

(b) Non-Federal use is limited to the radio astronomy service and as provided by footnote US13.

**US128** In the band 10-10.5 GHz, pulsed emissions are prohibited, except for weather radars on board meteorological satellites in the sub-band 10-10.025 GHz. The amateur service, the amateur-satellite service, and the non-Federal radiolocation service, which shall not cause harmful interference to the Federal radiolocation service, are the only non-Federal services permitted in this band. The non-Federal radiolocation service is limited to survey operations as specified in footnote US108.

**US130** The band 10.6-10.68 GHz is also allocated on a primary basis to the radio astronomy service. However, the radio astronomy service shall not receive protection from stations in the fixed service which are licensed to operate in the one hundred most populous urbanized areas as defined by the 1990 U.S. Census. For the list of observatories operating in this band, see footnote US131.

**US131** In the band 10.7-11.7 GHz, non-geostationary satellite orbit licensees in the fixed-satellite service (space-to-Earth), prior to commencing operations, shall coordinate with the following radio astronomy observatories to achieve a mutually acceptable agreement regarding the protection of the radio telescope facilities operating in the band 10.6-10.7 GHz:

Observatory	North latitude	West longitude	Elevation (in meters)
Arecibo Observatory, PR.....	18° 20' 37"	66° 45' 11"	497
Green Bank Telescope (GBT), WV.....	38° 25' 59"	79° 50' 23"	807
Very Large Array (VLA), Socorro, NM.....	34° 04' 44"	107° 37' 06"	2115
Very Long Baseline Array (VLBA) Stations:			
Brewster, WA.....	48° 07' 52"	119° 41' 00"	250
Fort Davis, TX.....	30° 38' 06"	103° 56' 41"	1606
Hancock, NH.....	42° 56' 01"	71° 59' 12"	296
Kitt Peak, AZ.....	31° 57' 23"	111° 36' 45"	1902
Los Alamos, NM.....	35° 46' 30"	106° 14' 44"	1962
Mauna Kea, HI.....	19° 48' 05"	155° 27' 20"	3763
North Liberty, IA.....	41° 46' 17"	91° 34' 27"	222
Owens Valley, CA.....	37° 13' 54"	118° 16' 37"	1196
Pie Town, NM.....	34° 18' 04"	108° 07' 09"	2365
St. Croix, VI.....	17° 45' 24"	64° 35' 01"	16

**US132A** In the bands 26.2-26.42 MHz, 41.015-41.665 MHz, and 43.35-44 MHz, applications of radiolocation service are limited to oceanographic radars operating in accordance with ITU Resolution 612 (Rev.WRC-12). Oceanographic radars shall not cause harmful interference to, or claim protection from, non-Federal stations in the land mobile service in the bands 26.2-26.42 MHz and 43.69-44 MHz, Federal stations in the fixed or mobile services in the band 41.015-41.665 MHz, and non-Federal stations in the fixed or land mobile services in the band 43.35-43.69 MHz.

**US133** In the bands 14-14.2 GHz and 14.47-14.5 GHz, the following provisions shall apply to the operations of Earth Stations Aboard Aircraft (ESAA):

(a) In the band 14-14.2 GHz, ESAA licensees proposing to operate within radio line-of-sight of the coordinates specified in 47 CFR 25.228(j)(1) are subject to prior coordination with NTIA in order to minimize harmful interference to the ground terminals of NASA's Tracking and Data Relay Satellite System



(TDRSS).

(b) In the band 14.47-14.5 GHz, operations within radio line-of-sight of the radio astronomy stations specified in 47 CFR 25.228(j)(3) are subject to coordination with the National Science Foundation in accordance with the requirements set forth in that rule section.

**US136** The following provisions shall apply in eight HF bands that are allocated to the broadcasting service (HFBC) on a primary basis in all Regions.

(a) In Alaska, the assigned frequency band 7368.48-7371.32 kHz is allocated exclusively to the fixed service (FS) on a primary basis for non-Federal use in accordance with 47 CFR 80.387.

(b) On the condition that harmful interference is not caused to the broadcasting service (NIB operations), Federal and non-Federal stations that communicate wholly within the United States and its insular areas may operate as specified herein. All such stations must take account of the seasonal use of frequencies by the broadcasting service published in accordance with Article 12 of the ITU Radio Regulations and are limited to the minimum power needed for reliable communications.

(1) *Federal stations.* Frequencies in the 13 HF bands/sub-bands listed in the table below (HF NIB Bands) may be authorized to Federal stations in the FS. In the bands 5.9-5.95, 7.3-7.4, 13.57-13.6, and 13.80-13.87 MHz (6, 7, 13.6, and 13.8 MHz bands), frequencies may also be authorized to Federal stations in the mobile except aeronautical mobile route (R) service (MS except AM(R)S). Federal use of the bands 9.775-9.9, 11.65-11.7, and 11.975-12.05 MHz is restricted to stations in the FS that were authorized as of June 12, 2003, and each grandfathered station is restricted to a total radiated power of 24 dBW. In all other HF NIB Bands (\*), new Federal stations may be authorized.

(2) *Non-Federal stations.* Non-Federal use of the HF NIB Bands is restricted to stations in the FS, land mobile service (LMS), and maritime mobile service (MMS) that were licensed prior to March 25, 2007, except that, in the sub-band 7.35-7.4 MHz, use is restricted to stations that were licensed prior to March 29, 2009.

NIB OPERATIONS IN EIGHT HFBC BANDS (MHZ)

HF NIB Band	Federal (*new stations permitted)	Non-Federal	HFBC Band
5.90-5.95	*FS and MS except AM(R)S .....	MMS .....	....5.90-6.20
7.30-7.40	*FS and MS except AM(R)S .....	FS, LMS and MMS	....7.30-7.40
9.40-9.50	*9 MHz: FS .....	FS and LMS .....	....9.40-9.90
9.775-9.90	FS (Grandfathered, restricted to 24 dBW)		
11.60-11.65	*11 MHz: FS .....	FS .....	11.60-12.10
11.65-11.70	FS (Grandfathered, restricted to 24 dBW)		
11.975-12.05	FS (Grandfathered, restricted to 24 dBW)		
12.05-12.10	*12 MHz: FS .....	FS	
13.57-13.60	*FS and MS except AM(R)S .....	MMS .....	13.57-13.87
13.80-13.87	*FS and MS except AM(R)S .....	MMS	
15.60-15.80	*15 MHz: FS .....	FS .....	15.10-15.80
17.48-17.55	*17 MHz: FS .....	.....	17.48-17.90
18.90-19.02	*19 MHz: FS .....	MMS .....	18.90-19.02

NOTE: Non-Federal stations may continue to operate in nine HF NIB Bands as follows: (i) In the 6, 7, 13.6, 13.8, and 19 MHz bands, stations in the MMS; (ii) In the 7 and 9 MHz bands, stations in the FS and LMS; and (iii) In the 11, 12, and 15 MHz band, stations in the FS.

**US139** Fixed stations authorized in the band 18.3-19.3 GHz under the provisions of 47 CFR 74.502(c), 74.602(g), 78.18(a)(4), and 101.147(r) may continue operations consistent with the provisions of those sections.

**US142** In the bands 7.2-7.3 and 7.4-7.45 MHz, the following provisions shall apply:

(a) In the U.S. Pacific insular areas located in Region 3 (*see* 47 CFR 2.105(a), note 3), the bands 7.2-7.3 and 7.4-7.45 MHz are alternatively allocated to the broadcasting service on a primary basis. Use of this allocation is restricted to international broadcast stations that transmit to geographical zones and areas of reception in Region 1 or Region 3.

(b) The use of the band 7.2-7.3 MHz in Region 2 by the amateur service shall not impose constraints on the broadcasting service intended for use within Region 1 and Region 3.

**US145** The following unwanted emissions power limits for non-geostationary satellites operating in the inter-satellite service that transmit in the band 22.55-23.55 GHz shall apply in any 200 MHz of the passive band 23.6-24 GHz, based on the date that complete advance publication information is received by the ITU's Radiocommunication Bureau:

(a) For information received before January 1, 2020:  $-36$  dBW/200 MHz.

(b) For information received on or after January 1, 2020:  $-46$  dBW/200 MHz.

**US151** In the band 37-38 GHz, stations in the fixed and mobile services shall not cause harmful interference to Federal earth stations in the space research service (space-to-Earth) at the following sites: Goldstone, CA; Socorro, NM; and White Sands, NM. Applications for non-Federal use of this band shall be coordinated with NTIA in accordance with 47 CFR 30.205.

**US156** In the bands 49.7-50.2 GHz and 50.4-50.9 GHz, for earth stations in the fixed-satellite service (Earth-to-space), the unwanted emissions power in the band 50.2-50.4 GHz shall not exceed  $-20$  dBW/ 200 MHz (measured at the input of the antenna), except that the maximum unwanted emissions power may be increased to  $-10$  dBW/200 MHz for earth stations having an antenna gain greater than or equal to 57 dBi. These limits apply under clear-sky conditions. During fading conditions, the limits may be exceeded by earth stations when using uplink power control.

**US157** In the band 51.4-52.6 GHz, for stations in the fixed service, the unwanted emissions power in the band 52.6-54.25 GHz shall not exceed  $-33$  dBW/100 MHz (measured at the input of antenna).

**US161** In the bands 81-86 GHz, 92-94 GHz, and 94.1-95 GHz and within the coordination distances indicated below, assignments to allocated services shall be coordinated with the following radio astronomy observatories. New observatories shall not receive protection from fixed stations that are licensed to operate in the one hundred most populous urbanized areas as defined by the U.S. Census Bureau for the year 2000.

(a) Within 25 km of the National Radio Astronomy Observatory's (NRAO's) Very Long Baseline Array (VLBA) Stations:

State	VLBA Station	Lat. (N)	Long. (W)
AZ	Kitt Peak	31° 57' 23"	111° 36' 45"
CA	Owens Valley	37° 13' 54"	118° 16' 37"
HI	Mauna Kea	19° 48' 05"	155° 27' 20"
IA	North Liberty	41° 46' 17"	091° 34' 27"
NH	Hancock	42° 56' 01"	071° 59' 12"
NM	Los Alamos	35° 46' 30"	106° 14' 44"

NM	Pie Town	34° 18' 04"	108° 07' 09"
TX	Fort Davis	30° 38' 06"	103° 56' 41"
VI	Saint Croix	17° 45' 24"	064° 35' 01"
WA	Brewster	48° 07' 52"	119° 41' 00"

(b) Within 150 km of the following observatories:

State	Telescope and site	Lat. (N)	Long. (W)
AZ	Heinrich Hertz Submillimeter Observatory, Mt. Graham	32° 42' 06"	109° 53' 28"
AZ	University of Arizona 12-m Telescope, Kitt Peak	31° 57' 12"	111° 36' 53"
CA	Caltech Telescope, Owens Valley	37° 13' 54"	118° 17' 36"
CA	Combined Array for Research in Millimeter-wave Astronomy (CARMA)	37° 16' 43"	118° 08' 32"
HI	James Clerk Maxwell Telescope, Mauna Kea	19° 49' 33"	155° 28' 47"
MA	Haystack Observatory, Westford	42° 37' 24"	071° 29' 18"
NM	NRAO's Very Large Array, Socorro	34° 04' 44"	107° 37' 06"
WV	NRAO's Robert C. Byrd Telescope, Green Bank	38° 25' 59"	079° 50' 23"

NOTE: Satisfactory completion of the coordination procedure utilizing the automated mechanism, see 47 CFR 101.1523, will be deemed to establish sufficient separation from radio astronomy observatories, regardless of whether the distances set forth above are met.

**US205** Tropospheric scatter systems are prohibited in the band 2500-2690 MHz.

**US208** Planning and use of the band 1559-1626.5 MHz necessitate the development of technical and/or operational sharing criteria to ensure the maximum degree of electromagnetic compatibility with existing and planned systems within the band.

**US209** The use of frequencies 460.6625, 460.6875, 460.7125, 460.7375, 460.7625, 460.7875, 460.8125, 460.8375, 460.8625, 465.6625, 465.6875, 465.7125, 465.7375, 465.7625, 465.7875, 465.8125, 465.8375, and 465.8625 MHz may be authorized, with 100 mW or less output power, to Federal and non-Federal radio stations for one-way, non-voice bio-medical telemetry operations in hospitals, or medical or convalescent centers.

**US210** In the bands 40.66-40.7 MHz and 216-220 MHz, frequencies may be authorized to Federal and non-Federal stations on a secondary basis for the tracking of, and telemetering of scientific data from, ocean buoys and wildlife. Operation in these bands is subject to the technical standards specified in: (a) Section 8.2.42 of the NTIA Manual for Federal use, or (b) 47 CFR 90.248 for non-Federal use. After January 1, 2002, no new assignments shall be authorized in the band 216-217 MHz.

**US211** In the bands 1670-1690, 5000-5250 MHz and 10.7-11.7, 15.1365-15.35, 15.4-15.7, 22.5-22.55, 24-24.05, 31.0-31.3, 31.8-32.0, 40.5-42.5, 116-122.25, 123-130, 158.5-164, 167-168, 191.8-200, and 252-265 GHz, applicants for airborne or space station assignments are urged to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference; however, US74 applies.

**US212** In, or within 92.6 km (50 nautical miles) of, the State of Alaska, the carrier frequency 5167.5 kHz (assigned frequency 5168.9 kHz) is designated for emergency communications. This frequency may also be used in the Alaska-Private Fixed Service for calling and listening, but only for establishing communications before switching to another frequency. The maximum power is limited to 150 watts peak envelope power (PEP).

**US213** The frequency 122.925 MHz is for use only for communications with or between aircraft when coordinating natural resources programs of Federal or State natural resources, agencies, including forestry management and fire suppression, fish and game management and protection and environmental monitoring and protection.

**US214** The frequency 157.1 MHz is the primary frequency for liaison communications between ship stations and stations of the United States Coast Guard.

**US218** The band 902-928 MHz is available for Location and Monitoring Service (LMS) systems subject to not causing harmful interference to the operation of all Federal stations authorized in this band. These systems must tolerate interference from the operation of industrial, scientific, and medical (ISM) equipment and the operation of Federal stations authorized in this band.

**US220** The frequencies 36.25 and 41.71 MHz may be authorized to Federal stations and non-Federal stations in the petroleum radio service, for oil spill containment and cleanup operations. The use of these frequencies for oil spill containment or cleanup operations is limited to the inland and coastal waterway regions.

**US221** Use of the mobile service in the bands 525-535 kHz and 1605-1615 kHz is limited to distribution of public service information from Travelers Information stations operating on 530 kHz and 1610 kHz.

**US222** In the band 2025-2035 MHz, geostationary operational environmental satellite (GOES) earth stations in the space research and Earth exploration-satellite services may be authorized on a coequal basis for Earth-to-space transmissions for tracking, telemetry, and telecommand at Honolulu, HI (21° 21' 12" N, 157° 52' 36" W); Seattle, WA (47° 34' 15" N, 122° 33' 10" W); and Wallops Island, VA (37° 56' 44" N, 75° 27' 42" W).

**US224** Federal systems utilizing spread spectrum techniques for terrestrial communication, navigation and identification may be authorized to operate in the band 960-1215 MHz on the condition that harmful interference will not be caused to the aeronautical radionavigation service. These systems will be handled on a case-by-case basis. Such systems shall be subject to a review at the national level for operational requirements and electromagnetic compatibility prior to development, procurement or modification.

**US225** In addition to its present Federal use, the band 510-525 kHz is available to Federal and non-Federal aeronautical radionavigation stations inland of the Territorial Base Line as coordinated with the military services. In addition, the frequency 510 kHz is available for non-Federal ship-helicopter operations when beyond 100 nautical miles from shore and required for aeronautical radionavigation.

**US227** The bands 156.4875-156.5125 MHz and 156.5375-156.5625 MHz are also allocated to the fixed and land mobile services on a primary basis for non-Federal use in VHF Public Coast Station Areas 10-42. The use of these bands by the fixed and land mobile services shall not cause harmful interference to, nor claim protection from, the maritime mobile VHF radiocommunication service.

**US230** The bands 422.1875-425.4875 MHz and 427.1875-429.9875 MHz are allocated to the land mobile service on a primary basis for non-Federal use within 80.5 kilometers (50 miles) of Cleveland, OH (41° 29' 51.2" N, 81° 41' 49.5" W) and Detroit, MI (42° 19' 48.1" N, 83° 02' 56.7" W). The bands 423.8125-425.4875 MHz and 428.8125-429.9875 MHz are allocated to the land mobile service on a primary basis for non-Federal use within 80.5 kilometers of Buffalo, NY (42° 52' 52.2" N, 78° 52' 20.1" W).

**US231** When an assignment cannot be obtained in the bands between 200 kHz and 525 kHz, which are allocated to aeronautical radionavigation, assignments may be made to aeronautical radiobeacons in the maritime mobile bands at 435-472 kHz and 479-490 kHz, on a secondary basis, subject to the coordination and agreement of those agencies having assignments within the maritime mobile bands which may be affected. Assignments to Federal aeronautical radionavigation radiobeacons in the bands 435-472 kHz and 479-490 kHz shall not be a bar to any required changes to the maritime mobile radio service and shall be limited to non-voice emissions.

**US239** Aeronautical radionavigation stations (radiobeacons) may be authorized, primarily for off-shore use, in the band 525-535 kHz on a non-interference basis to travelers information stations.

**US240** The bands 1715-1725 and 1740-1750 kHz are allocated on a primary basis and the bands 1705-1715 kHz and 1725-1740 kHz on a secondary basis to the aeronautical radionavigation service (radiobeacons).

**US241** The following provision shall apply to Federal operations in the band 216-220.035 MHz:

(a) Use of the fixed and land mobile services in the band 216-220 MHz and of the aeronautical mobile service in the sub-band 217-220 MHz is restricted to telemetry and associated telecommand operations. New stations in the fixed and land mobile services shall not be authorized in the sub-band 216-217 MHz.

(b) The sub-band 216.965-216.995 MHz is also allocated to the Federal radiolocation service on a primary basis and the use of this allocation is restricted to the Air Force Space Surveillance System (AFSSS) radar system. AFSSS stations transmit on the frequency 216.98 MHz and other operations may be affected within: 1) 250 km of Lake Kickapoo (Archer City), TX (33° 2' 48" N, 98° 45' 46" W); and 2) 150 km of Gila River (Phoenix), AZ (33° 6' 32" N, 112° 1' 45" W) and Jordan Lake (Wetumpka), AL (32° 39' 33" N, 86° 15' 52" W). AFSSS reception shall be protected from harmful interference within 50 km of: 1) Elephant Butte, NM (33° 26' 35" N, 106° 59' 50" W); 2) Fort Stewart, GA (31° 58' 36" N, 81° 30' 34" W); 3) Hawkinsville, GA (32° 17' 20" N, 83° 32' 10" W); 4) Red River, AR (33° 19' 48" N, 93° 33' 1" W); 5) San Diego, CA (32° 34' 42" N, 116° 58' 11" W); and 6) Silver Lake, MS (33° 8' 42" N, 91° 1' 16" W).

(c) The sub-band 219.965-220.035 MHz is also allocated to the Federal radiolocation service on a secondary basis and the use of this allocation is restricted to air-search radars onboard Coast Guard vessels.

**US242** Use of the fixed and land mobile services in the band 220-222 MHz shall be in accordance with the following plan:

(a) Frequencies are assigned in pairs, with base station transmit frequencies taken from the sub-band 220-221 MHz and with corresponding mobile and control station transmit frequencies being 1 MHz higher and taken from the sub-band 221-222 MHz.

(b) In the non-Federal exclusive sub-bands, temporary fixed geophysical telemetry operations are also permitted on a secondary basis.

(c) The use of Channels 161-170 is restricted to public safety/mutual aid communications.

(d) The use of Channels 181-185 is restricted to emergency medical communications.

220 MHz PLAN			
Use	Base Transmit	Mobile Transmit	Channel Nos.
Non-Federal exclusive	220.00-220.55	221.00-221.55	001-110
Federal exclusive.....	220.55-220.60	221.55-221.60	111-120
Non-Federal exclusive	220.60-220.80	221.60-221.80	121-160
Shared.....	220.80-220.85	221.80-221.85	161-170
Non-Federal exclusive	220.85-220.90	221.85-221.90	171-180
Shared.....	220.90-220.925	221.90-221.925	181-185
Non-Federal exclusive	220.925-221	221.925-222	186-200

**US244** The band 136-137 MHz is allocated to the non-Federal aeronautical mobile (R) service on a primary basis, and is subject to pertinent international treaties and agreements. The frequencies 136, 136.025, 136.05, 136.075, 136.1, 136.125, 136.15, 136.175, 136.2, 136.225, 136.25, 136.275, 136.3, 136.325, 136.35, 136.375, 136.4, 136.425, 136.45, and 136.475 MHz are available on a shared basis to the Federal Aviation Administration for air traffic control purposes, such as automatic weather observation stations

(AWOS), automatic terminal information services (ATIS), flight information services-broadcast (FIS-B), and airport control tower communications.

**US245** In the bands 3600-3650 MHz (space-to-Earth), 4500-4800 MHz (space-to-Earth), and 5850-5925 MHz (Earth-to-space), the use of the non-Federal fixed-satellite service is limited to international inter-continental systems and is subject to case-by-case electromagnetic compatibility analysis. The FCC's policy for these bands is codified at 47 CFR 2.108.

**US246** No station shall be authorized to transmit in the following bands: 73-74.6 MHz, 608-614 MHz, except for medical telemetry equipment<sup>1</sup> and white space devices,<sup>2</sup> 1400-1427 MHz, 1660.5-1668.4 MHz, 2690-2700 MHz, 4990-5000 MHz, 10.68-10.7 GHz, 15.35-15.4 GHz, 23.6-24 GHz, 31.3-31.8 GHz, 50.2-50.4 GHz, 52.6-54.25 GHz, 86-92 GHz, 100-102 GHz, 109.5-111.8 GHz, 114.25-116 GHz, 148.5-151.5 GHz, 164-167 GHz, 182-185 GHz, 190-191.8 GHz, 200-209 GHz, 226-231.5 GHz, 250-252 GHz.

**US247** The band 10 100-10 150 kHz is allocated to the fixed service on a primary basis outside the United States and its insular areas. Transmissions from stations in the amateur service shall not cause harmful interference to this fixed service use and stations in the amateur service shall make all necessary adjustments (including termination of transmission) if harmful interference is caused.

**US251** The band 12.75-13.25 GHz is also allocated to the space research (deep space) (space-to-Earth) service for reception only at Goldstone, CA (35° 20' N, 116° 53' W).

**US252** The band 2110-2120 MHz is also allocated to the space research service (deep space) (Earth-to-space) on a primary basis at Goldstone, CA (35° 20' N, 116° 53' W).

**US254** In the band 18.6-18.8 GHz the fixed and mobile services shall be limited to a maximum equivalent isotropically radiated power of +35 dBW and the power delivered to the antenna shall not exceed -3 dBW.

**US255** In addition to any other applicable limits, the power flux-density across the 200 MHz band 18.6-18.8 GHz produced at the surface of the Earth by emissions from a space station under assumed free-space propagation conditions shall not exceed -95 dB(W/m<sup>2</sup>) for all angles of arrival. This limit may be exceeded by up to 3 dB for no more than 5% of the time.

**US258** In the bands 8025-8400 MHz and 25.5-27 GHz, the Earth exploration-satellite service (space-to-Earth) is allocated on a primary basis for non-Federal use. Authorizations are subject to a case-by-case electromagnetic compatibility analysis.

**US259** In the band 17.3-17.7 GHz, Federal stations in the radiolocation service shall operate with an e.i.r.p. of less than 51 dBW.

**US260** Aeronautical mobile communications which are an integral part of aeronautical radionavigation systems may be satisfied in the bands 1559-1626.5 MHz, 5000-5250 MHz and 15.4-15.7 GHz.

**US261** The use of the band 4200-4400 MHz by the aeronautical radionavigation service is reserved exclusively for airborne radio altimeters. Experimental stations will not be authorized to develop equipment for operational use in this band other than equipment related to altimeter stations. However, passive sensing in the Earth-exploration satellite and space research services may be authorized in this band on a secondary basis (no protection is provided from the radio altimeters).

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<sup>1</sup> Medical telemetry equipment shall not cause harmful interference to radio astronomy operations in the band 608-614 MHz and shall be coordinated under the requirements found in 47 CFR 95.1119.

<sup>2</sup> White space devices shall not cause harmful interference to radio astronomy operations in the band 608-614 MHz and shall not operate within the areas described in 47 CFR 15.712(h).

**US262** The band 7145-7190 MHz is also allocated to the space research service (deep space) (Earth-to-space) on a secondary basis for non-Federal use. Federal and non-Federal use of the bands 7145-7190 MHz and 34.2-34.7 GHz by the space research service (deep space) (Earth-to-space) and of the band 31.8-32.3 GHz by the space research service (deep space) (space-to-Earth) is limited to Goldstone, CA (35° 20' N, 116° 53' W).

**US264** In the band 48.94-49.04 GHz, airborne stations shall not be authorized.

**US266** Non-Federal licensees in the Public Safety Radio Pool holding a valid authorization on June 30, 1958, to operate in the frequency band 156.27-157.45 MHz or on the frequencies 161.85 MHz or 161.91 MHz may, upon proper application, continue to be authorized for such operation, including expansion of existing systems, until such time as harmful interference is caused to the operation of any authorized station other than those licensed in the Public Safety Radio Pool.

**US267** In the band 902-928 MHz, amateur stations shall transmit only in the sub-bands 902-902.4, 902.6-904.3, 904.7-925.3, 925.7-927.3, and 927.7-928 MHz within the States of Colorado and Wyoming, bounded by the area of latitudes 39° N and 42° N and longitudes 103° W and 108° W.

**US268** The bands 890-902 MHz and 928-942 MHz are also allocated to the radiolocation service for Federal ship stations (off-shore ocean areas) on the condition that harmful interference is not caused to non-Federal land mobile stations. The provisions of footnote US116 apply.

**US269** In the band 420-450 MHz, the following provisions shall apply to the non-Federal radiolocation service:

(a) Pulse-ranging radiolocation systems may be authorized for use along the shoreline of the conterminous United States and Alaska.

(b) In the sub-band 420-435 MHz, spread spectrum radiolocation systems may be authorized within the conterminous United States and Alaska.

(c) All stations operating in accordance with this provision shall be secondary to stations operating in accordance with the Table of Frequency Allocations.

(d) Authorizations shall be granted on a case-by-case basis; however, operations proposed to be located within the areas listed in paragraph (a) of US270 should not expect to be accommodated.

**US270** In the band 420-450 MHz, the following provisions shall apply to the amateur service:

(a) The peak envelope power of an amateur station shall not exceed 50 watts in the following areas, unless expressly authorized by the FCC after mutual agreement, on a case-by-case basis, between the Regional Director of the applicable field office and the military area frequency coordinator at the applicable military base. For areas (5) through (7), the appropriate military coordinator is located at Peterson AFB, CO.

(1) Arizona, Florida and New Mexico.

(2) Within those portions of California and Nevada that are south of latitude 37° 10' N.

(3) Within that portion of Texas that is west of longitude 104° W.

(4) Within 322 km of Eglin AFB, FL (30° 30' N, 86° 30' W); Patrick AFB, FL (28° 21' N, 80° 43' W); and the Pacific Missile Test Center, Point Mugu, CA (34° 09' N, 119° 11' W).

(5) Within 240 km of Beale AFB, CA (39° 08' N, 121° 26' W).

(6) Within 200 km of Goodfellow AFB, TX (31° 25' N, 100° 24' W) and Warner Robins AFB, GA (32° 38' N, 83° 35' W).

(7) Within 160 km of Clear AFS, AK (64° 17' N, 149° 10' W); Concrete, ND (48° 43' N, 97° 54' W); and Otis AFB, MA (41° 45' N, 70° 32' W).

(b) In the sub-band 420-430 MHz, the amateur service is not allocated north of Line A (def. § 2.1).

**US273** In the bands 74.6-74.8 MHz and 75.2-75.4 MHz, stations in the fixed and mobile services are limited to a maximum power of 1 watt from the transmitter into the antenna transmission line.

**US275** The band 902-928 MHz is allocated on a secondary basis to the amateur service subject to not causing harmful interference to the operations of Federal stations authorized in this band or to Location and Monitoring Service (LMS) systems. Stations in the amateur service must tolerate any interference from the operations of industrial, scientific, and medical (ISM) devices, LMS systems, and the operations of Federal stations authorized in this band. Further, the amateur service is prohibited in those portions of Texas and New Mexico bounded on the south by latitude 31° 41' North, on the east by longitude 104° 11' West, and on the north by latitude 34° 30' North, and on the west by longitude 107° 30' West; in addition, outside this area but within 150 miles of these boundaries of White Sands Missile Range the service is restricted to a maximum transmitter peak envelope power output of 50 watts.

**US276** Except as otherwise provided for herein, use of the band 2360-2395 MHz by the mobile service is limited to aeronautical telemetering and associated telecommand operations for flight testing of aircraft, missiles or major components thereof. The following three frequencies are shared on a co-equal basis by Federal and non-Federal stations for telemetering and associated telecommand operations of expendable and reusable launch vehicles, whether or not such operations involve flight testing: 2364.5 MHz, 2370.5 MHz, and 2382.5 MHz. All other mobile telemetering uses shall not cause harmful interference to, or claim protection from interference from, the above uses.

**US278** In the bands 22.55-23.55 GHz and 32.3-33 GHz, non-geostationary inter-satellite links may operate on a secondary basis to geostationary inter-satellite links.

**US279** The frequency 2182 kHz may be authorized to fixed stations associated with the maritime mobile service for the sole purpose of transmitting distress calls and distress traffic, and urgency and safety signals and messages.

**US281** In the band 25 070-25 210 kHz, non-Federal stations in the Industrial/Business Pool shall not cause harmful interference to, and must accept interference from, stations in the maritime mobile service operating in accordance with the Table of Frequency Allocations.

**US282** In the band 4650-4700 kHz, frequencies may be authorized for non-Federal communication with helicopters in support of off-shore drilling operations on the condition that harmful interference will not be caused to services operating in accordance with the Table of Frequency Allocations.

**US283** In the bands 2850-3025 kHz, 3400-3500 kHz, 4650-4700 kHz, 5450-5680 kHz, 6525-6685 kHz, 10 005-10 100 kHz, 11 275-11 400 kHz, 13 260-13 360 kHz, and 17 900-17 970 kHz, frequencies may be authorized for non-Federal flight test purposes on the condition that harmful interference will not be caused to services operating in accordance with the Table of Frequency Allocations.

**US285** Under exceptional circumstances, the carrier frequencies 2635 kHz, 2638 kHz, and 2738 kHz may be authorized to coast stations.

**US287** In the maritime mobile service, the frequencies 457.525 MHz, 457.550 MHz, 457.575 MHz, 467.525 MHz, 467.550 MHz and 467.575 MHz may be used by on-board communication stations. Where needed, equipment designed for 12.5 kHz channel spacing using also the additional frequencies 457.5375 MHz, 457.5625 MHz, 467.5375 MHz and 467.5625 MHz may be introduced for on-board communications. The use of these frequencies in territorial waters may be subject to the national regulations of the administration concerned. The characteristics of the equipment used shall conform to those specified in Recommendation ITU-R M.1174-2.

**US288** In the territorial waters of the United States, the preferred frequencies for use by on-board communication stations shall be 457.525 MHz, 457.550 MHz, 457.575 MHz and 457.600 MHz paired, respectively, with 467.750 MHz, 467.775 MHz, 467.800 MHz and 467.825 MHz. Where needed, equipment designed for 12.5 kHz channel spacing using also the additional frequencies 457.5375 MHz, 457.5625 MHz, 467.5375 MHz and 467.5625 MHz may be introduced for on-board communications. The



characteristics of the equipment used shall conform to those specified in Recommendation ITU-R M.1174-2.

**US289** In the bands 460-470 MHz and 1690-1695 MHz, the following provisions shall apply:

(a) In the band 460-470 MHz, space stations in the Earth exploration-satellite service (EESS) may be authorized for space-to-Earth transmissions on a secondary basis with respect to the fixed and mobile services. When operating in the meteorological-satellite service, such stations shall be protected from harmful interference from other EESS applications. The power flux density produced at the Earth's surface by any space station in this band shall not exceed  $-152 \text{ dBW/m}^2/4 \text{ kHz}$ .

(b) In the band 1690-1695 MHz, EESS applications, other than the meteorological-satellite service, may also be used for space-to-Earth transmissions subject to not causing harmful interference to stations operating in accordance with the Table of Frequency Allocations.

**US296** In the bands designated for ship wide-band telegraphy, facsimile and special transmission systems, the following assignable frequencies are available to non-Federal stations on a shared basis with Federal stations: 2070.5 kHz, 2072.5 kHz, 2074.5 kHz, 2076.5 kHz, 4154 kHz, 4170 kHz, 6235 kHz, 6259 kHz, 8302 kHz, 8338 kHz, 12 370 kHz, 12 418 kHz, 16 551 kHz, 16 615 kHz, 18 848 kHz, 18 868 kHz, 22 182 kHz, 22 238 kHz, 25 123 kHz, and 25 159 kHz.

**US297** The bands 47.2-49.2 GHz and 81-82.5 GHz are also available for feeder links for the broadcasting-satellite service.

**US298** The assigned frequencies 27.555, 27.615, 27.635, 27.655, 27.765, and 27.860 MHz are available for use by forest product licensees on a secondary basis to Federal operations including experimental stations. Non-Federal operations on these frequencies will not exceed 150 watts output power and are limited to the states of Washington, Oregon, Maine, North Carolina, South Carolina, Tennessee, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas (eastern portion).

**US299** In Alaska, the band 1615-1705 kHz is also allocated to the maritime mobile and Alaska fixed services on a secondary basis to Region 2 broadcast operations.

**US300** The frequencies 169.445, 169.505, 169.545, 169.575, 169.605, 169.995, 170.025, 170.055, 170.245, 170.305, 171.045, 171.075, 171.105, 171.845, 171.875, and 171.905 MHz are available for wireless microphone operations on a secondary basis to Federal and non-Federal operations. On center frequencies 169.575 MHz, 170.025 MHz, 171.075 MHz, and 171.875 MHz, the emission bandwidth shall not exceed 200 kHz. On the other center frequencies, the emission bandwidth shall not exceed 54 kHz.

**US301** Except as provided in NG30, broadcast auxiliary stations licensed as of November 21, 1984, to operate in the band 942-944 MHz may continue to operate on a co-equal primary basis to other stations and services operating in the band in accordance with the Table of Frequency Allocations.

**US303** In the band 2285-2290 MHz, non-Federal space stations in the space research, space operations and Earth exploration-satellite services may be authorized to transmit to the Tracking and Data Relay Satellite System subject to such conditions as may be applied on a case-by-case basis. Such transmissions shall not cause harmful interference to authorized Federal stations. The power flux-density at the Earth's surface from such non-Federal stations shall not exceed  $-144$  to  $-154 \text{ dBW/m}^2/4 \text{ kHz}$ , depending on angle of arrival, in accordance with ITU Radio Regulation 21.16.

**US307** The band 5150-5216 MHz is also allocated to the fixed-satellite service (space-to-Earth) for feeder links in conjunction with the radiodetermination-satellite service operating in the bands 1610-1626.5 MHz and 2483.5-2500 MHz. The total power flux-density at the Earth's surface shall in no case exceed  $-159 \text{ dBW/m}^2$  per 4 kHz for all angles of arrival.

**US308** In the bands 1549.5-1558.5 MHz and 1651-1660 MHz, those requirements of the aeronautical mobile-satellite (R) service that cannot be accommodated in the bands 1545-1549.5 MHz, 1558.5-1559 MHz, 1646.5-1651 MHz and 1660-1660.5 MHz shall have priority access with real-time preemptive

capability for communications in the mobile-satellite service. Systems not interoperable with the aeronautical mobile-satellite (R) service shall operate on a secondary basis. Account shall be taken of the priority of safety-related communications in the mobile-satellite service.

**US309** In the bands 1545-1559 MHz, transmissions from terrestrial aeronautical stations directly to aircraft stations, or between aircraft stations, in the aeronautical mobile (R) service are also authorized when such transmissions are used to extend or supplement the satellite-to-aircraft links. In the band 1646.5-1660.5 MHz, transmissions from aircraft stations in the aeronautical mobile (R) service directly to terrestrial aeronautical stations, or between aircraft stations, are also authorized when such transmissions are used to extend or supplement the aircraft-to-satellite links.

**US310** In the band 14.896-15.121 GHz, non-Federal space stations in the space research service may be authorized on a secondary basis to transmit to Tracking and Data Relay Satellites subject to such conditions as may be applied on a case-by-case basis. Such transmissions shall not cause harmful interference to authorized Federal stations. The power flux-density (pfd) produced by such non-Federal stations at the Earth's surface in any 1 MHz band for all conditions and methods of modulation shall not exceed:

–124 dB(W/m<sup>2</sup>) for  $0^\circ < \theta < 5^\circ$

–124 +  $(\theta - 5)/2$  dB(W/m<sup>2</sup>) for  $5^\circ < \theta < 25^\circ$

–114 dB(W/m<sup>2</sup>) for  $25^\circ < \theta < 90^\circ$

where  $\theta$  is the angle of arrival of the radio-frequency wave (degrees above the horizontal). These limits relate to the pfd and angles of arrival which would be obtained under free-space propagation conditions.

**US312** The frequency 173.075 MHz may also be authorized on a primary basis to non-Federal stations in the Public Safety Radio Pool, limited to police licensees, for stolen vehicle recovery systems (SVRS). As of May 27, 2005, new SVRS licenses shall be issued for an authorized bandwidth not to exceed 12.5 kHz. Stations that operate as part of a stolen vehicle recovery system that was authorized and in operation prior to May 27, 2005 may operate with an authorized bandwidth not to exceed 20 kHz until May 27, 2019. After that date, all SVRS shall operate with an authorized bandwidth not to exceed 12.5 kHz.

**US315** In the bands 1530-1544 MHz and 1626.5-1645.5 MHz, maritime mobile-satellite distress and safety communications, *e.g.*, GMDSS, shall have priority access with real-time preemptive capability in the mobile-satellite service. Communications of mobile-satellite system stations not participating in the GMDSS shall operate on a secondary basis to distress and safety communications of stations operating in the GMDSS. Account shall be taken of the priority of safety-related communications in the mobile-satellite service.

**US316** The band 2900-3000 MHz is also allocated to the meteorological aids service on a primary basis for Federal use. Operations in this service are limited to Next Generation Weather Radar (NEXRAD) systems where accommodation in the band 2700-2900 MHz is not technically practical and are subject to coordination with existing authorized stations.

**US319** In the bands 137-138 MHz, 148-149.9 MHz, 149.9-150.05 MHz, 399.9-400.05 MHz, 400.15-401 MHz, 1610-1626.5 MHz, and 2483.5-2500 MHz, Federal stations in the mobile-satellite service shall be limited to earth stations operating with non-Federal space stations.

**US320** The use of the bands 137-138 MHz, 148-150.05 MHz, 399.9-400.05 MHz, and 400.15-401 MHz by the mobile-satellite service is limited to non-voice, non-geostationary satellite systems and may include satellite links between land earth stations at fixed locations.

**US323** In the band 148-149.9 MHz, no individual mobile earth station shall transmit on the same frequency being actively used by fixed and mobile stations and shall transmit no more than 1% of the time during any 15 minute period; except, individual mobile earth stations in this band that do not avoid frequencies actively being used by the fixed and mobile services shall not exceed a power density of –16 dBW/4 kHz and shall transmit no more than 0.25% of the time during any 15 minute period. Any single transmission from any individual mobile earth station operating in this band shall not exceed 450 ms in duration and consecutive

transmissions from a single mobile earth station on the same frequency shall be separated by at least 15 seconds. Land earth stations in this band shall be subject to electromagnetic compatibility analysis and coordination with terrestrial fixed and mobile stations.

**US324** In the band 400.15-401 MHz, Federal and non-Federal satellite systems shall be subject to electromagnetic compatibility analysis and coordination.

**US325** In the band 148-149.9 MHz fixed and mobile stations shall not claim protection from land earth stations in the mobile-satellite service that have been previously coordinated; Federal fixed and mobile stations exceeding 27 dBW EIRP, or an emission bandwidth greater than 38 kHz, will be coordinated with existing mobile-satellite service space stations.

**US327** The band 2310-2360 MHz is allocated to the broadcasting-satellite service (sound) and complementary terrestrial broadcasting service on a primary basis. Such use is limited to digital audio broadcasting and is subject to the provisions of Resolution 528.

**US334** In the bands between 17.7 GHz and 20.2 GHz, the following provisions shall apply:

(a) In the bands between 17.8 GHz and 20.2 GHz, Federal space stations in both geostationary (GSO) and non-geostationary satellite orbits (NGSO) and associated earth stations in the fixed-satellite service (FSS) (space-to-Earth) may be authorized on a primary basis. For a Federal GSO FSS network to operate on a primary basis, the space station shall be located outside the arc, measured from east to west, 70-120° West longitude. Coordination between Federal FSS systems and non-Federal space and terrestrial systems operating in accordance with the United States Table of Frequency Allocations is required.

(b) In the bands between 17.8 GHz and 20.2 GHz, Federal earth stations operating with Federal space stations shall be authorized on a primary basis only in the following areas: Denver, Colorado; Washington, DC; San Miguel, California; and Guam. Prior to the commencement of non-Federal terrestrial operations in these areas, the FCC shall coordinate with NTIA all applications for new stations and modifications to existing stations as specified in 47 CFR 1.924(f), 74.32, and 78.19(f). In the band 17.7-17.8 GHz, the FCC shall also coordinate with NTIA all applications for new stations and modifications to existing stations that support the operations of Multichannel Video Programming Distributors (MVPD) in these areas, as specified in the aforementioned regulations.

(c) In the bands between 17.8 GHz and 19.7 GHz, the power flux-density (pfd) at the surface of the Earth produced by emissions from a Federal GSO space station or from a Federal space station in a NGSO constellation of 50 or fewer satellites, for all conditions and for all methods of modulation, shall not exceed the following values in any 1 MHz band:

- (1)  $-115 \text{ dB(W/m}^2\text{)}$  for angles of arrival above the horizontal plane ( $\delta$ ) between 0° and 5°,
- (2)  $-115 + 0.5(\delta - 5) \text{ dB(W/m}^2\text{)}$  for  $\delta$  between 5° and 25°, and
- (3)  $-105 \text{ dB(W/m}^2\text{)}$  for  $\delta$  between 25° and 90°.

(d) In the bands between 17.8 GHz and 19.3 GHz, the pfd at the surface of the Earth produced by emissions from a Federal space station in an NGSO constellation of 51 or more satellites, for all conditions and for all methods of modulation, shall not exceed the following values in any 1 MHz band:

- (1)  $-115 - X \text{ dB(W/m}^2\text{)}$  for  $\delta$  between 0° and 5°,
- (2)  $-115 - X + ((10 + X)/20)(\delta - 5) \text{ dB(W/m}^2\text{)}$  for  $\delta$  between 5° and 25°, and
- (3)  $-105 \text{ dB(W/m}^2\text{)}$  for  $\delta$  between 25° and 90°; where X is defined as a function of the number of satellites, n, in an NGSO constellation as follows:

For  $n \leq 288$ ,  $X = (5/119)(n - 50) \text{ dB}$ ; and

For  $n > 288$ ,  $X = (1/69)(n + 402) \text{ dB}$ .

**US337** In the band 13.75-13.8 GHz, the FCC shall coordinate earth stations in the fixed-satellite service with NTIA on a case-by-case basis in order to minimize harmful interference to the Tracking and Data Relay Satellite System's forward space-to-space link (TDRSS forward link-to-LEO).

**US338A** In the band 1435-1452 MHz, operators of aeronautical telemetry stations are encouraged to take all reasonable steps to ensure that the unwanted emissions power does not exceed –28 dBW/27 MHz in the band 1400-1427 MHz. Operators of aeronautical telemetry stations that do not meet this limit shall first attempt to operate in the band 1452-1525 MHz prior to operating in the band 1435-1452 MHz.

**US340** The band 2-30 MHz is available on a non-interference basis to Federal and non-Federal maritime and aeronautical stations for the purposes of measuring the quality of reception on radio channels. See 47 CFR 87.149 for the list of protected frequencies and bands within this frequency range. Actual communications shall be limited to those frequencies specifically allocated to the maritime mobile and aeronautical mobile services.

**US342** In making assignments to stations of other services to which the bands:

13 360-13 410 kHz	42.77-42.87 GHz*
25 550-25 670 kHz	43.07-43.17 GHz*
37.5-38.25 MHz	43.37-43.47 GHz*
322-328.6 MHz*	48.94-49.04 GHz*
1330-1400 MHz*	76-86 GHz
1610.6-1613.8 MHz*	92-94 GHz
1660-1660.5 MHz*	94.1-100 GHz
1668.4-1670 MHz*	102-109.5 GHz
3260-3267 MHz*	111.8-114.25 GHz
3332-3339 MHz*	128.33-128.59 GHz*
3345.8-3352.5 MHz*	129.23-129.49 GHz*
4825-4835 MHz*	130-134 GHz
4950-4990 MHz	136-148.5 GHz
6650-6675.2 MHz*	151.5-158.5 GHz
14.47-14.5 GHz*	168.59-168.93 GHz*
22.01-22.21 GHz*	171.11-171.45 GHz*
22.21-22.5 GHz	172.31-172.65 GHz*
22.81-22.86 GHz*	173.52-173.85 GHz*
23.07-23.12 GHz*	195.75-196.15 GHz*
31.2-31.3 GHz	209-226 GHz
36.43-36.5 GHz*	241-250 GHz
42.5-43.5 GHz	252-275 GHz

are allocated (\*indicates radio astronomy use for spectral line observations), all practicable steps shall be taken to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (*see* ITU Radio Regulations at Nos. 4.5 and 4.6 and Article 29).

**US343** In the mobile service, the frequencies between 1435 and 1525 MHz will be assigned for aeronautical telemetry and associated telecommand operations for flight testing of manned or unmanned aircraft and missiles, or their major components. Permissible usage includes telemetry associated with launching and reentry into the Earth's atmosphere as well as any incidental orbiting prior to reentry of manned objects undergoing flight tests. The following frequencies are shared on a co-equal basis with flight telemetering mobile stations: 1444.5, 1453.5, 1501.5, 1515.5, and 1524.5 MHz.

**US344** In the band 5091-5250 MHz, the FCC shall coordinate earth stations in the fixed-satellite service (Earth-to-space) with NTIA (see Recommendation ITU-R S.1342). In order to better protect the operation of the international standard system (microwave landing system) in the band 5000-5091 MHz, non-Federal tracking and telecommand operations should be conducted in the band 5150-5250 MHz.

**US346** Except as provided for below and by US222, Federal use of the band 2025-2110 MHz by the space operation service (Earth-to-space), Earth exploration-satellite service (Earth-to-space), and space research

service (Earth-to-space) shall not constrain the deployment of the Television Broadcast Auxiliary Service, the Cable Television Relay Service, or the Local Television Transmission Service. To facilitate compatible operations between non-Federal terrestrial receiving stations at fixed sites and Federal earth station transmitters, coordination is required. To facilitate compatible operations between non-Federal terrestrial transmitting stations and Federal spacecraft receivers, the terrestrial transmitters in the band 2025-2110 MHz shall not be high-density systems (see Recommendations ITU-R SA.1154 and ITU-R F.1247). Military satellite control stations at the following sites shall operate on a co-equal, primary basis with non-Federal operations:

Facility	Coordinates	
Naval Satellite Control Network, Prospect Harbor, ME	44° 24' 16" N	068° 00' 46" W
New Hampshire Tracking Station, New Boston AFS, NH	42° 56' 52" N	071° 37' 36" W
Eastern Vehicle Check-out Facility & GPS Ground Antenna & Monitoring Station, Cape Canaveral, FL	28° 29' 09" N	080° 34' 33" W
Buckley AFB, CO	39° 42' 55" N	104° 46' 36" W
Colorado Tracking Station, Schriever AFB, CO	38° 48' 21" N	104° 31' 43" W
Kirtland AFB, NM	34° 59' 46" N	106° 30' 28" W
Camp Parks Communications Annex, Pleasanton, CA	37° 43' 51" N	121° 52' 50" W
Naval Satellite Control Network, Laguna Peak, CA	34° 06' 31" N	119° 03' 53" W
Vandenberg Tracking Station, Vandenberg AFB, CA	34° 49' 21" N	120° 30' 07" W
Hawaii Tracking Station, Kaena Pt, Oahu, HI	21° 33' 44" N	158° 14' 31" W
Guam Tracking Stations, Anderson AFB, and Naval CTS, Guam	13° 36' 54" N	144° 51' 18" E

**US347** In the band 2025-2110 MHz, non-Federal Earth-to-space and space-to-space transmissions may be authorized in the space research and Earth exploration-satellite services subject to such conditions as may be applied on a case-by-case basis. Such transmissions shall not cause harmful interference to Federal and non-Federal stations operating in accordance with the Table of Frequency Allocations.

**US349** The band 3650-3700 MHz is also allocated to the Federal radiolocation service on a non-interference basis for use by ship stations located at least 44 nautical miles in off-shore ocean areas on the condition that harmful interference is not caused to non-Federal operations.

**US350** In the band 1427-1432 MHz, Federal use of the land mobile service and non-Federal use of the fixed and land mobile services is limited to telemetry and telecommand operations as described further:

(a) *Medical operations.* The use of the band 1427-1432 MHz for medical telemetry and telecommand operations (medical operations) shall be authorized for both Federal and non-Federal stations.

(1) Medical operations shall be authorized in the band 1427-1429.5 MHz in the United States and its insular areas, except in the following locations: Austin/Georgetown, Texas; Detroit and Battle Creek, Michigan; Pittsburgh, Pennsylvania; Richmond/Norfolk, Virginia; Spokane, Washington; and Washington DC metropolitan area (collectively, the “carved-out” locations). See Section 47 C.F.R. 90.259(b)(4) for a detailed description of these areas.

(2) In the carved-out locations, medical operations shall be authorized in the band 1429-1431.5 MHz.

(3) Medical operations may operate on frequencies in the band 1427-1432 MHz other than those described in paragraphs (a)(1) and (2) only if the operations were registered with a designated frequency coordinator prior to April 14, 2010.

(b) *Non-medical operations.* The use of the band 1427-1432 MHz for non-medical telemetry and telecommand operations (non-medical operations) shall be limited to non-Federal stations.

(1) Non-medical operations shall be authorized on a secondary basis to the Wireless Medical Telemetry Service (WMTS) in the band 1427-1429.5 MHz and on a primary basis in the band 1429.5-1432 MHz in the United States and its insular areas, except in the carved-out locations.

(2) In the carved-out locations, non-medical operations shall be authorized on a secondary basis in the band 1429-1431.5 MHz and on a primary basis in the bands 1427-1429 MHz and 1431.5-1432 MHz.

**US353** In the bands 56.24-56.29 GHz, 58.422-58.472 GHz, 59.139-59.189 GHz, 59.566-59.616 GHz, 60.281-60.331 GHz, 60.41-60.46 GHz, and 62.461-62.511 GHz, space-based radio astronomy observations may be made on an unprotected basis.

**US354** In the band 58.422-58.472 GHz, airborne stations and space stations in the space-to-Earth direction shall not be authorized.

**US356** In the band 13.75-14 GHz, an earth station in the fixed-satellite service shall have a minimum antenna diameter of 4.5 m and the e.i.r.p. of any emission should be at least 68 dBW and should not exceed 85 dBW. In addition the e.i.r.p., averaged over one second, radiated by a station in the radiolocation service shall not exceed 59 dBW. Receiving space stations in the fixed-satellite service shall not claim protection from radiolocation transmitting stations operating in accordance with the United States Table of Frequency Allocations. ITU Radio Regulation No. 5.43A does not apply.

**US357** In the band 13.75-14 GHz, geostationary space stations in the space research service for which information for advance publication has been received by the ITU Radiocommunication Bureau (Bureau) prior to 31 January 1992 shall operate on an equal basis with stations in the fixed-satellite service; after that date, new geostationary space stations in the space research service will operate on a secondary basis. Until those geostationary space stations in the space research service for which information for advance publication has been received by the Bureau prior to 31 January 1992 cease to operate in this band:

a) the e.i.r.p. density of emissions from any earth station in the fixed-satellite service operating with a space station in geostationary-satellite orbit shall not exceed 71 dBW in any 6 MHz band from 13.77 to 13.78 GHz;

b) the e.i.r.p. density of emissions from any earth station in the fixed-satellite service operating with a space station in non-geostationary-satellite orbit shall not exceed 51 dBW in any 6 MHz band from 13.77 to 13.78 GHz.

Automatic power control may be used to increase the e.i.r.p. density in any 6 MHz band in these frequency ranges to compensate for rain attenuation, to the extent that the power flux-density at the fixed-satellite service space station does not exceed the value resulting from use by an earth station of an e.i.r.p. of 71 dBW or 51 dBW, as appropriate, in any 6 MHz band in clear-sky conditions.

**US359** In the band 15.43-15.63 GHz, use of the fixed-satellite service (Earth-to-space) is limited to non-Federal feeder links of non-geostationary systems in the mobile-satellite service. The FCC shall coordinate earth stations in this band with NTIA (see Annex 3 of Recommendation ITU-R S.1340).

**US360** The band 33-36 GHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis for Federal use. Coordination between Federal fixed-satellite service systems and non-Federal systems operating in accordance with the United States Table of Frequency Allocations is required.

**US362** The band 1670-1675 MHz is allocated to the meteorological-satellite service (space-to-Earth) on a primary basis for Federal use. Earth station use of this allocation is limited to Wallops Island, VA (37° 56' 44" N, 75° 27' 37" W), Fairbanks, AK (64° 58' 22" N, 147° 30' 04" W), and Greenbelt, MD (39° 00' 02" N, 76° 50' 29" W). Applicants for non-Federal stations within 100 kilometers of the Wallops Island or Fairbanks coordinates and within 65 kilometers of the Greenbelt coordinates shall notify NOAA in accordance with the procedures specified in 47 CFR 1.924.

**US364** Consistent with US18, stations may be authorized on a primary basis in the band 285-325 kHz for the specific purpose of transmitting differential global positioning system information.

**US378** In the band 1710-1755 MHz, the following provisions apply:

(a) Federal fixed and tactical radio relay stations may operate indefinitely on a primary basis within 80 km of Cherry Point, NC (34° 58' N, 76° 56' W) and Yuma, AZ (32° 32' N, 113° 58' W).

(b) Federal fixed and tactical radio relay stations shall operate on a secondary basis to primary non-Federal operations at the 14 sites listed below:

80 km radius of operation centered on:		
State	Location	Coordinates
CA	China Lake	35° 41' N, 117° 41' W
CA	Pacific Missile Test Range/Point Mugu	34° 07' N, 119° 30' W
FL	Eglin AFB	30° 29' N, 086° 31' W
MD	Patuxent River	38° 17' N, 076° 25' W
NM	White Sands Missile Range	33° 00' N, 106° 30' W
NV	Nellis AFB	36° 14' N, 115° 02' W
UT	Hill AFB	41° 07' N, 111° 58' W
50 km radius of operation centered on:		
AL	Fort Rucker	31° 13' N, 085° 49' W
CA	Fort Irwin	35° 16' N, 116° 41' W
GA	Fort Benning	32° 22' N, 084° 56' W
GA	Fort Stewart	31° 52' N, 081° 37' W
KY	Fort Campbell	36° 41' N, 087° 28' W
NC	Fort Bragg	35° 09' N, 079° 01' W
WA	Fort Lewis	47° 05' N, 122° 36' W

(c) In the sub-band 1710-1720 MHz, precision guided munitions shall operate on a primary basis until inventory is exhausted or until December 31, 2008, whichever is earlier.

(d) All other Federal stations in the fixed and mobile services shall operate on a primary basis until reaccommodated in accordance with the Commercial Spectrum Enhancement Act.

**US379** In the band 55.78-56.26 GHz, in order to protect stations in the Earth exploration-satellite service (passive), the maximum power density delivered by a transmitter to the antenna of a fixed service station is limited to  $-28.5$  dB(W/MHz).

**US380** In the bands 1525-1544 MHz, 1545-1559 MHz, 1610-1645.5 MHz, 1646.5-1660.5 MHz, and 2483.5-2500 MHz, a non-Federal licensee in the mobile-satellite service (MSS) may also operate an ancillary terrestrial component in conjunction with its MSS network, subject to the Commission's rules for ancillary terrestrial components and subject to all applicable conditions and provisions of its MSS authorization.

**US382** In the band 39.5-40 GHz, Federal earth stations in the mobile-satellite service (space-to-Earth) shall not claim protection from non-Federal stations in the fixed and mobile services. ITU Radio Regulation No. 5.43A does not apply.

**US384** In the band 401-403 MHz, the non-Federal Earth exploration-satellite (Earth-to-space) and meteorological-satellite (Earth-to-space) services are limited to earth stations transmitting to Federal space stations.

**US385** Radio astronomy observations may be made in the bands 1350-1400 MHz, 1718.8-1722.2 MHz, and 4950-4990 MHz on an unprotected basis, and in the band 2655-2690 MHz on a secondary basis, at the following radio astronomy observatories:

Allen Telescope Array, Hat Creek, CA	Rectangle between latitudes 40° 00' N and 42° 00' N and between longitudes 120° 15' W and 122° 15' W.
NASA Goldstone Deep Space Communications Complex, Goldstone, CA	80 kilometers (50 mile) radius centered on 35° 20' N, 116° 53' W.
National Astronomy and Ionosphere Center, Arecibo, PR	Rectangle between latitudes 17° 30' N and 19° 00' N and between longitudes 65° 10' W and 68° 00' W.
National Radio Astronomy Observatory, Socorro, NM	Rectangle between latitudes 32° 30' N and 35° 30' N and between longitudes 106° 00' W and 109° 00' W.

National Radio Astronomy Observatory, Green Bank, WV	Rectangle between latitudes 37° 30' N and 39° 15' N and between longitudes 78° 30' W and 80° 30' W.	
National Radio Astronomy Observatory, Very Long Baseline Array Stations	80 kilometer radius centered on:	
	North latitude	West longitude
Brewster, WA	48° 08'	119° 41'
Fort Davis, TX	30° 38'	103° 57'
Hancock, NH	42° 56'	71° 59'
Kitt Peak, AZ	31° 57'	111° 37'
Los Alamos, NM	35° 47'	106° 15'
Mauna Kea, HI	19° 48'	155° 27'
North Liberty, IA	41° 46'	91° 34'
Owens Valley, CA	37° 14'	118° 17'
Pie Town, NM	34° 18'	108° 07'
Saint Croix, VI	17° 45'	64° 35'
Owens Valley Radio Observatory, Big Pine, CA	Two contiguous rectangles, one between latitudes 36° 00' N and 37° 00' N and between longitudes 117° 40' W and 118° 30' W and the second between latitudes 37° 00' N and 38° 00' N and between longitudes 118° 00' W and 118° 50' W.	

(a) In the bands 1350-1400 MHz and 4950-4990 MHz, every practicable effort will be made to avoid the assignment of frequencies to stations in the fixed and mobile services that could interfere with radio astronomy observations within the geographic areas given above. In addition, every practicable effort will be made to avoid assignment of frequencies in these bands to stations in the aeronautical mobile service which operate outside of those geographic areas, but which may cause harmful interference to the listed observatories. Should such assignments result in harmful interference to these observatories, the situation will be remedied to the extent practicable.

(b) In the band 2655-2690 MHz, for radio astronomy observations performed at the locations listed above, licensees are urged to coordinate their systems through the National Science Foundation, Division of Astronomical Sciences, Electromagnetic Spectrum Management Unit, 2415 Eisenhower Avenue, Alexandria, VA 22314; Email: [esm@nsf.gov](mailto:esm@nsf.gov).

**US389** In the bands 71-76 GHz and 81-86 GHz, stations in the fixed, mobile, and broadcasting services shall not cause harmful interference to, nor claim protection from, Federal stations in the fixed-satellite service at any of the following 28 military installations:

Military Installation	State	Nearby city
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Redstone Arsenal.....	AL	Huntsville
Fort Huachuca.....	AZ	Sierra Vista
Yuma Proving Ground.....	AZ	Yuma
Beale AFB.....	CA	Marysville
Camp Parks Reserve Forces Training Area.....	CA	Dublin
China Lake Naval Air Weapons Station.....	CA	Ridgecrest
Edwards AFB.....	CA	Rosamond
Fort Irwin.....	CA	Barstow
Marine Corps Air Ground Combat Center.....	CA	Twentynine Palms
Buckley AFB.....	CO	Aurora (Denver)
Schriever AFB.....	CO	Colorado Springs
Fort Gordon.....	GA	Augusta
Naval Satellite Operations Center.....	GU	Finegayan (Guam)
Naval Computer and Telecommunications Area Master Station, Pacific	HI	Wahiawa (Oahu Is.)
Fort Detrick.....	MD	Frederick
Nellis AFB.....	NV	Las Vegas
Nevada Test Site.....	NV	Amargosa Valley
Tonapah Test Range Airfield.....	NV	Tonapah
Cannon AFB.....	NM	Clovis
White Sands Missile Range.....	NM	White Sands
Dyess AFB.....	TX	Abilene
Fort Bliss.....	TX	El Paso
Fort Sam Houston.....	TX	San Antonio
Goodfellow AFB.....	TX	San Angelo
Kelly AFB.....	TX	San Antonio
Utah Test and Training Range.....	UT	.....
Fort Belvoir.....	VA	Alexandria
Naval Satellite Operations Center.....	VA	Chesapeake

**US390** Federal stations in the space research service (active) operating in the band 5350-5460 MHz shall not cause harmful interference to, nor claim protection from, Federal and non-Federal stations in the aeronautical radionavigation service nor Federal stations in the radiolocation service.

**US391** In the band 2495-2500 MHz, the mobile-satellite service (space-to-Earth) shall not receive protection from non-Federal stations in the fixed and mobile except aeronautical mobile services operating in that band.

**US397** In the band 432-438 MHz, the Earth exploration-satellite service (active) is allocated on a secondary basis for Federal use. Stations in the Earth exploration-satellite service (active) shall not be operated within line-of-sight of the United States except for the purpose of short duration pre-operational testing. Operations under this allocation shall not cause harmful interference to, nor claim protection from, any other services allocated in the band 432-438 MHz in the United States, including secondary services and the amateur-satellite service.

**US402** In the band 17.3-17.7 GHz, existing Federal satellites and associated earth stations in the fixed-satellite service (Earth-to-space) are authorized to operate on a primary basis in the frequency bands and areas listed below. Non Federal Receiving earth stations in the broadcasting-satellite service and fixed satellite service within the bands and areas listed below shall not claim protection from Federal earth stations in the fixed-satellite service.

(a) 17.600-17.700 GHz for stations within a 120 km radius of 38° 49' N latitude and 76° 52' W longitude.

(b) 17.375-17.475 GHz for stations within a 160 km radius of 39° 42' N latitude and 104° 45' W longitude.

**US431B** The band 3450-3550 MHz is allocated on a primary basis to the Federal radiolocation service and to the non-Federal fixed and mobile, except aeronautical mobile, services on a nationwide basis. Federal operations in the band 3450-3550 MHz shall not cause harmful interference to non-Federal operations, except under the following circumstances.

(a) *Cooperative Planning Areas.* Cooperative Planning Areas (CPAs) are geographic locations in which non-Federal operations shall coordinate with Federal systems in the band to deploy non-Federal operations in a manner that shall not cause harmful interference to Federal systems operating in the band. In addition, operators of non-Federal stations may be required to modify their operations (*e.g.*, reduce power, filtering, adjust antenna pointing angles, shielding, *etc.*) to protect Federal operations against harmful interference and to avoid, where possible, interference and potential damage to the non-Federal operators' systems. In these areas, non-Federal operations may not claim interference protection from Federal systems. Federal and non-Federal operators may reach mutually acceptable operator-to-operator agreements to permit more extensive non-Federal use by identifying and mutually agreeing upon a technical approach that mitigates the interference risk to Federal operations. To the extent possible, Federal use in CPAs will be chosen to minimize operational impact on non-Federal users. The table in paragraph (d) identifies the locations of CPAs, including, for information, those with high powered Federal operations. CPAs may also be Periodic Use Areas as described below. Coordination between Federal users and non-Federal licensees in CPAs shall be consistent with rules and procedures established by the FCC and NTIA.

(b) *Periodic Use Areas.* Periodic Use Areas (PUAs) are geographic locations in which non-Federal operations in the band shall not cause harmful interference to Federal systems operating in the band for episodic periods. During these times and in these areas, Federal users will require interference protection from non-Federal operations. Operators of non-Federal stations may be required to temporarily modify their operations (*e.g.*, reduce power, filtering, adjust antenna pointing angles, shielding, *etc.*) to protect Federal operations from harmful interference, which may include restrictions on non-Federal stations' ability to radiate at certain locations during specific periods of time. During such episodic use, non-Federal users in PUAs must alter their operations to avoid harmful interference to Federal systems' temporary use of the band, and during such times, non-Federal operations may not claim interference protection from Federal systems. Federal and non-Federal operators may reach mutually acceptable operator-to-operator agreements such that a Federal operator may not need to activate a PUA if a mutually agreeable technical approach mitigates the interference risk to Federal operations. To the extent possible, Federal use in PUAs will be chosen to minimize operational impact on non-Federal users. Coordination between Federal users and non-Federal licensees in PUAs shall be consistent with rules and procedures established by the FCC and NTIA. While all PUAs are co-located with CPAs, the exact geographic area used during periodic use may differ from the co-located CPA. The geographic locations of PUAs are identified in the table in paragraph (d). Restrictions and authorizations for the CPAs remain in effect during periodic use unless specifically relieved in the coordination process.

(c) For the CPA at Little Rock, AR, after approximately 12 months from the close of the auction, non-Federal operations shall coordinate with Federal systems in only the 3450-3490 MHz band segment and the 3490-3550 MHz band segment will be available for non-federal use without coordination. At Fort Bragg, NC, non-Federal operations shall coordinate with Federal systems in only the 3450-3490 MHz band segment.

(d) The following table identifies the coordinates for the location of each CPA and PUA. An area may be represented as either a polygon made up of several corresponding coordinates or a circle represented by a center point and a radius. If a CPA has a corresponding PUA, the PUA coordinates are provided. A location marked with an asterisk (\*) indicates a high-power federal radiolocation facility. If a location includes a Shipboard Electronic Systems Evaluation Facility (SESEF) attached to a homeport, it specifies the associated SESEF.

**Table: Department of Defense Cooperative Planning Areas and Periodic Use Areas**

Location name	State	CPA	PUA	Latitude	Longitude	Radius (km)
Little Rock	AR	Yes	-	37° 28' 34" 37° 42' 55" 36° 38' 29" 34° 57' 57" 32° 09' 36" 31° 51' 52" 32° 12' 11" 33° 42' 22" 35° 17' 35" 36° 12' 18"	94° 28' 24" 88° 54' 36" 87° 52' 34" 88° 09' 26" 92° 06' 54" 93° 10' 35" 94° 37' 07" 95° 49' 52" 96° 23' 06" 96° 08' 46"	N/A
Yuma Complex (includes Yuma Proving Grounds and MCAS Yuma)	AZ	Yes	Yes	33° 36' 44" 34° 03' 08" 34° 03' 56" 33° 26' 54" 32° 51' 17" 32° 16' 54" 32° 14' 39" 32° 20' 06" 32° 28' 30" 32° 53' 20"	115° 10' 44" 114° 41' 08" 114° 05' 56" 113° 03' 54" 113° 02' 17" 113° 45' 54" 114° 40' 39" 114° 55' 06" 115° 02' 30" 115° 09' 20"	N/A
Camp Pendleton	CA	Yes	-	33° 21' 46"	117° 25' 25"	50
Edwards Air Force Base	CA	Yes	Yes	35° 19' 16" 35° 17' 54" 35° 11' 43" 35° 00' 52" 34° 44' 17" 34° 34' 16" 34° 26' 55" 34° 28' 59" 34° 41' 36" 35° 07' 32"	118° 03' 16" 117° 26' 54" 117° 15' 43" 117° 10' 52" 117° 10' 17" 117° 19' 16" 117° 47' 55" 118° 16' 59" 118° 28' 36" 118° 25' 32"	N/A
National Training Center	CA	Yes	Yes	36° 03' 31" 36° 03' 09" 35° 41' 46" 35° 07' 24" 34° 42' 43" 34° 44' 22" 35° 02' 28" 35° 34' 49"	117° 00' 45" 116° 20' 43" 115° 44' 31" 115° 44' 09" 116° 17' 58" 117° 05' 19" 117° 35' 18" 117° 27' 37"	N/A

Location name	State	CPA	PUA	Latitude	Longitude	Radius (km)
Naval Air Weapons Station, China Lake*	CA	Yes	Yes	36° 36' 42" 35° 54' 45" 35° 00' 01" 34° 54' 34" 35° 44' 22" 36° 30' 18"	117° 20' 42" 116° 31' 45" 116° 39' 01" 117° 26' 34" 118° 17' 22" 118° 07' 18"	N/A
Point Mugu	CA	Yes	Yes	34° 06' 44"	119° 06' 36"	38
San Diego* (includes Point Loma SESEF range)	CA	Yes	-	33° 4' 10" 32° 27' 19" 32° 33' 29" 32° 47' 16" 33° 1' 20" 33° 20' 36" 33° 24' 36" 32° 52' 54" 33° 04' 10"	117° 35' 40" 118° 0' 37" 116° 51' 8" 116° 28' 5" 116° 31' 5" 116° 47' 10" 117° 0' 51" 117° 9' 35" 117° 35' 40"	N/A
Twentynine Palms	CA	Yes	-	34° 06' 44"	116° 06' 36"	75
Eglin Air Force Base (includes Santa Rosa Island & Cape San Blas site)	FL	Yes	Yes	Eglin and Santa Rosa Island: 30° 29' 28.5" Cape San Blas: 29° 40' 37"	Eglin and Santa Rosa Island: 86° 45' 00" Cape San Blas: 85° 20' 50"	35
Mayport* (includes Mayport SESEF range)	FL	Yes	-	30° 23' 42"	81° 24' 41"	64
Pensacola*	FL	Yes	Yes	30° 20' 50"	87° 18' 40"	93
Joint Readiness Training Center	LA	Yes	Yes	31° 54' 23" 31° 50' 54" 31° 18' 13" 30° 46' 33" 30° 29' 14" 30° 46' 22" 31° 25' 16"	93° 20' 53" 92° 52' 46" 92° 26' 31" 92° 28' 32" 93° 4' 1" 93° 41' 26" 94° 3' 19"	N/A
Chesapeake Beach*	MD	Yes	Yes	38° 39' 24"	76° 31' 41"	95
Naval Air Station, Patuxent River  CPA	MD	Yes	Yes	38° 26' 22" 38° 51' 51" 38° 28' 11" 38° 03' 40" 37° 45' 33" 37° 34' 34" 37° 38' 10" 38° 09' 32" 38° 18' 46" 38° 26' 59"	76° 14' 12" 75° 48' 34" 75° 28' 53" 75° 30' 31" 75° 45' 50" 76° 20' 09" 76° 44' 37" 76° 29' 28" 76° 34' 36" 76° 26' 27"	N/A

Location name	State	CPA	PUA	Latitude	Longitude	Radius (km)
PUA				38° 33' 38" 39° 11' 10" 38° 38' 51" 37° 52' 13" 37° 29' 44" 37° 10' 24" 37° 20' 05" 38° 01' 11" 38° 20' 54" 38° 35' 47"	76° 07' 29" 75° 29' 28" 75° 00' 40" 75° 03' 24" 75° 22' 25" 76° 16' 42" 77° 06' 52" 76° 36' 06" 76° 46' 41" 76° 30' 02"	
St. Inigoes*	MD	Yes	Yes	38° 08' 41"	76° 26' 03"	87
Bath*	ME	Yes	Yes	44° 02' 29" 43° 52' 27" 43° 48' 53" 43° 32' 50" 43° 27' 16" 43° 44' 26" 43° 54' 57" 44° 06' 56" 44° 17' 2" 44° 26' 54" 44° 36' 16" 44° 33' 45" 44° 57' 05" 44° 56' 27" 44° 32' 13" 44° 24' 08" 44° 02' 29"	70° 10' 41" 70° 10' 29" 70° 01' 6" 69° 57' 30" 69° 42' 52" 69° 13' 52" 69° 24' 50" 69° 25' 13" 69° 16' 56" 69° 45' 13" 69° 56' 50" 70° 04' 01" 70° 14' 55" 70° 19' 38" 70° 08' 17" 70° 36' 36" 70° 10' 41"	N/A
Pascagoula*	MS	Yes	Yes	30° 20' 42"	88° 34' 17"	80
Camp Lejeune	NC	Yes	-	34° 37' 51"	77° 24' 28"	54
Cherry Point	NC	Yes	-	34° 54' 57"	76° 53' 24"	38
Fort Bragg	NC	Yes	-	37° 35' 01" 37° 45' 56" 37° 22' 33" 36° 38' 56" 34° 43' 13" 33° 29' 44" 33° 24' 04" 34° 01' 05" 35° 27' 24" 36° 27' 46"	79° 31' 19" 77° 14' 14" 76° 18' 30" 75° 51' 26" 76° 15' 37" 78° 29' 53" 80° 29' 07" 81° 23' 49" 81° 37' 00" 81° 22' 49"	N/A

Location name	State	CPA	PUA	Latitude	Longitude	Radius (km)
Portsmouth*	NH	Yes	Yes	42° 23' 06" 42° 25' 05" 42° 21' 36" 42° 18' 28" 42° 13' 01" 42° 06' 30" 42° 02' 54" 42° 08' 03" 42° 10' 25" 42° 15' 39" 42° 22' 44" 42° 34' 56" 42° 52' 26" 43° 13' 48" 43° 31' 21" 43° 45' 21" 43° 59' 20" 43° 36' 10" 43° 49' 27" 43° 27' 40" 43° 00' 57" 42° 44' 40" 42° 51' 47" 42° 33' 46" 42° 24' 24" 42° 23' 06"	71° 10' 23" 71° 05' 43" 71° 00' 54" 70° 54' 35" 70° 44' 53" 70° 41' 11" 70° 37' 44" 70° 33' 35" 70° 20' 54" 70° 02' 39" 69° 48' 42" 69° 36' 01" 69° 26' 24" 69° 28' 18" 69° 40' 13" 70° 01' 31" 70° 30' 21" 70° 52' 5" 71° 15' 22" 71° 24' 47" 71° 53' 01" 71° 56' 37" 71° 27' 07" 71° 27' 12" 71° 21' 10" 71° 10' 23"	N/A
Moorestown*	NJ	Yes	Yes	40° 27' 26" 40° 02' 54" 39° 48' 19" 39° 38' 27" 39° 24' 59" 39° 17' 18" 39° 22' 16" 39° 29' 35" 39° 54' 43" 40° 15' 03" 40° 23' 29" 40° 42' 46" 40° 50' 59" 40° 52' 49" 40° 47' 42" 40° 33' 25" 40° 27' 26"	75° 42' 60" 75° 55' 12" 75° 55' 55" 75° 51' 48" 75° 21' 41" 74° 54' 09" 74° 27' 56" 74° 12' 59" 74° 00' 05" 74° 06' 20" 74° 08' 28" 74° 21' 54" 74° 31' 36" 74° 42' 53" 75° 03' 00" 75° 28' 15" 75° 42' 60"	N/A

Location name	State	CPA	PUA	Latitude	Longitude	Radius (km)
White Sands Missile Range	NM	Yes	Yes	34° 35' 05" 34° 43' 50" 34° 43' 17" 34° 26' 28" 32° 36' 02" 31° 45' 47" 31° 18' 18" 31° 27' 23" 32° 38' 49" 33° 32' 40"	107° 06' 05" 106° 46' 50" 106° 03' 17" 105° 26' 28" 104° 55' 02" 105° 22' 47" 106° 06' 18" 106° 54' 23" 107° 25' 49" 107° 27' 40"	N/A
Nevada Test and Training Range	NV	Yes	Yes	35° 58' 48" 36° 38' 22" 36° 22' 37" 36° 54' 03" 37° 58' 01" 38° 59' 48" 38° 58' 35" 37° 52' 34" 36° 20' 30" 36° 21' 15"	115° 31' 55" 116° 23' 51" 117° 41' 35" 117° 59' 18" 118° 01' 17" 116° 46' 01" 114° 49' 25" 113° 35' 46" 113° 39' 51" 115° 14' 23"	N/A
Fort Sill	OK	Yes	Yes	35° 03' 39" 35° 10' 31" 34° 42' 54" 34° 13' 49" 34° 13' 46" 34° 38' 26"	99° 02' 38" 98° 05' 47" 97° 45' 20" 98° 05' 49" 98° 56' 09" 99° 16' 57"	N/A
Tobyhanna Army Depot	PA	Yes	-	41° 30' 25" 41° 38' 51" 41° 31' 41" 41° 11' 31" 40° 52' 07" 40° 44' 53" 40° 51' 43" 41° 07' 40"	75° 51' 60" 75° 26' 33" 75° 1' 39" 74° 50' 07" 75° 1' 2" 75° 23' 50" 75° 48' 52" 76° 00' 38"	N/A

Location name	State	CPA	PUA	Latitude	Longitude	Radius (km)
Dahlgren*	VA	Yes	Yes	38° 23' 10" 38° 41' 25" 38° 46' 14" 38° 49' 37" 38° 50' 16" 38° 46' 30" 38° 49' 42" 38° 54' 42" 38° 55' 37" 38° 56' 05" 38° 44' 45" 38° 44' 22" 38° 35' 14" 38° 51' 04" 38° 26' 52" 38° 22' 59" 37° 59' 27" 37° 47' 08" 37° 54' 01" 38° 23' 10"	76° 23' 21" 76° 35' 56" 76° 44' 44" 76° 54' 57" 76° 58' 18" 77° 01' 57" 77° 04' 08" 77° 7' 35" 77° 12' 04" 77° 23' 5" 77° 25' 23" 77° 28' 48" 77° 36' 11" 78° 12' 06" 78° 29' 02" 77° 42' 19" 77° 28' 26" 76° 53' 47" 76° 06' 14" 76° 23' 21"	N/A
Newport News*	VA	Yes	Yes	36° 58' 24"	76° 26' 07"	93
Norfolk* (includes Fort Story SESEF range)	VA	Yes	-	36° 56' 24"	76° 19' 55"	74
Wallops Island*	VA	Yes	Yes	37° 51' 25"	75° 27' 59"	76
Bremerton*	WA	Yes	Yes	47° 28' 40" 47° 31' 16" 47° 31' 13" 47° 34' 12" 47° 45' 36" 47° 59' 07" 48° 12' 20" 47° 39' 46" 47° 39' 12" 47° 45' 23" 47° 44' 48" 47° 57' 40" 47° 31' 15" 47° 35' 53" 47° 27' 33" 47° 27' 07" 47° 24' 25" 47° 23' 07" 47° 28' 33" 46° 50' 25" 46° 53' 09" 47° 28' 40"	122° 31' 22" 122° 31' 26" 122° 32' 37" 122° 31' 52" 121° 32' 28" 121° 34' 09" 121° 44' 51" 122° 29' 60" 122° 34' 35" 122° 38' 09" 122° 45' 18" 122° 59' 06" 123° 16' 23" 122° 49' 28" 122° 55' 25" 122° 46' 16" 122° 42' 48" 122° 39' 18" 122° 33' 44" 121° 49' 24" 121° 44' 01" 122° 31' 22"	N/A



Location name	State	CPA	PUA	Latitude	Longitude	Radius (km)
Everett* (includes Ediz Hook SESEF range)	WA	Yes	-	47° 51' 11" 47° 25' 13" 47° 54' 45" 47° 36' 60" 47° 51' 57" 48° 35' 49" 48° 00' 8" 47° 51' 10"	122° 57' 47" 123° 18' 6" 122° 10' 13" 121° 37' 60" 121° 22' 57" 122° 08' 13" 123° 29' 33" 122° 57' 47"	N/A

**US433** In the band 3550-3650 MHz, the following provisions shall apply to Federal use of the aeronautical radionavigation (ground-based) and radiolocation services and to non-Federal use of the fixed and mobile except aeronautical mobile services:

(a) Non-Federal stations in the fixed and mobile except aeronautical mobile services are restricted to stations in the Citizens Broadband Radio Service and shall not cause harmful interference to, or claim protection from, Federal stations in the aeronautical radionavigation (ground-based) and radiolocation services at the locations listed at: [ntia.doc.gov/category/3550-3650-mhz](http://ntia.doc.gov/category/3550-3650-mhz). New and modified federal stations shall be allowed at current or new locations, subject only to approval through the National Telecommunications and Information Administration frequency assignment process with new locations added to the list at: [ntia.doc.gov/category/3550-3650-mhz](http://ntia.doc.gov/category/3550-3650-mhz). Coordination of the Federal stations with Citizens Broadband Radio Service licensees or users is not necessary. Federal operations, other than airborne radiolocation systems, shall be protected consistent with the procedures set forth in 47 CFR 96.15 and 96.67.

(b) Non-federal fixed and mobile stations shall not claim protection from federal airborne radar systems.

(c) Federal airborne radar systems shall not claim protection from non-Federal stations in the fixed and mobile except aeronautical mobile services operating in the band.

**US444** The frequency band 5030-5150 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. In the frequency band 5030-5091 MHz, the requirements of this system shall have priority over other uses of this band. For the use of the frequency band 5091-5150 MHz, US444A and Resolution 114 (Rev.WRC-12) of the ITU Radio Regulations apply.

**US444A** The band 5091-5150 MHz is also allocated to the fixed-satellite service (Earth-to-space) on a primary basis for non-Federal use. This allocation is limited to feeder links of non-geostationary satellite systems in the mobile-satellite service and is subject to coordination under No. 9.11A of the ITU Radio Regulations. In the band 5091-5150 MHz, the following conditions also apply:

(a) Prior to January 1, 2018, the use of the band 5091-5150 MHz by feeder links of non-geostationary-satellite systems in the mobile-satellite service shall be made in accordance with Resolution 114 (Rev.WRC-12);

(b) After January 1, 2016, no new assignments shall be made to earth stations providing feeder links of non-geostationary mobile-satellite systems; and

(c) After January 1, 2018, the fixed-satellite service will become secondary to the aeronautical radionavigation service.

**US444B** In the band 5091-5150 MHz, the following provisions shall apply to the aeronautical mobile service:

(a) Use is restricted to: (1) Systems operating in the aeronautical mobile (R) service (AM(R)S) in accordance with international aeronautical standards, limited to surface applications at airports, and in

accordance with Resolution 748 (Rev.WRC-12) (*i.e.*, AeroMACS); and (2) Aeronautical telemetry transmissions from aircraft stations (AMT) in accordance with Resolution 418 (Rev.WRC-12).

(b) Consistent with Radio Regulation No. 4.10, airport surface wireless systems operating in the AM(R)S have priority over AMT systems in the band.

(c) Operators of AM(R)S and AMT systems at the following airports are urged to cooperate with each other in the exchange of information about planned deployments of their respective systems so that the prospects for compatible sharing of the band are enhanced: 1) Boeing Field/King County Intl Airport, Seattle, WA; 2) Lambert-St. Louis Intl Airport, St. Louis, MO; 3) Charleston AFB/Intl Airport, Charleston, SC; 4) Wichita Dwight D. Eisenhower National Airport, Wichita, KS; 5) Roswell Intl Air Center Airport, Roswell, NM; and 6) William P. Gwinn Airport, Jupiter, FL. Other airports may be addressed on a case-by-case basis.

(d) Aeronautical fixed communications that are an integral part of the AeroMACS system authorized in paragraph (a)(1) are also authorized on a primary basis.

**US475** The use of the band 9300-9500 MHz by the aeronautical radionavigation service is limited to airborne radars and associated airborne beacons. In addition, ground-based radar beacons in the aeronautical radionavigation service are permitted in the band 9300-9320 MHz on the condition that harmful interference is not caused to the maritime radionavigation service.

**US476A** In the band 9300-9500 MHz, Federal stations in the Earth exploration-satellite service (active) and space research service (active) shall not cause harmful interference to, nor claim protection from, stations of the radionavigation and Federal radiolocation services.

**US482** In the band 10.6-10.68 GHz, the following provisions and urgings apply:

(a) Non-Federal use of the fixed service shall be restricted to point-to-point stations, with each station supplying not more than  $-3$  dBW of transmitter power to the antenna, producing not more than 40 dBW of EIRP, and radiating at an antenna main beam elevation angle of  $20^\circ$  or less. Licensees holding a valid authorization on August 6, 2015 to operate in this band may continue to operate as authorized, subject to proper license renewal.

(b) In order to minimize interference to the Earth exploration-satellite service (passive) receiving in this band, licensees of stations in the fixed service are urged to: (1) limit the maximum transmitter power supplied to the antenna to  $-15$  dBW; and (2) employ automatic transmitter power control (ATPC). The maximum transmitter power supplied to the antenna of stations using ATPC may be increased by a value corresponding to the ATPC range, up to a maximum of  $-3$  dBW.

**US511E** The use of the band 15.4-15.7 GHz by the radiolocation service is limited to Federal systems requiring a necessary bandwidth greater than 1600 MHz that cannot be accommodated within the band 15.7-17.3 GHz except as described below. In the band 15.4-15.7 GHz, stations operating in the radiolocation service shall not cause harmful interference to, nor claim protection from, radars operating in the aeronautical radionavigation service. Radar systems operating in the radiolocation service shall not be developed solely for operation in the band 15.4-15.7 GHz. Radar systems requiring use of the band 15.4-15.7 GHz for testing, training, and exercises may be accommodated on a case-by-case basis.

**US519** The band 18-18.3 GHz is also allocated to the meteorological-satellite service (space-to-Earth) on a primary basis. Its use is limited to geostationary satellites and shall be in accordance with the provisions of Article 21, Table 21-4 of the ITU Radio Regulations.

**US532** In the bands 21.2-21.4 GHz, 22.21-22.5 GHz, and 56.26-58.2 GHz, the space research and Earth exploration-satellite services shall not receive protection from the fixed and mobile services operating in accordance with the Table of Frequency Allocations.

**US550A** In the band 36-37 GHz, the following provisions shall apply:

(a) For stations in the mobile service, the transmitter power supplied to the antenna shall not exceed –10 dBW, except that the maximum transmitter power may be increased to –3 dBW for stations used for public safety and disaster management.

(b) For stations in the fixed service, the elevation angle of the antenna main beam shall not exceed 20° and the transmitter power supplied to the antenna shall not exceed:

(1) –5 dBW for hub stations of point-to-multipoint systems; or

(2) –10 dBW for all other stations, except that the maximum transmitter power of stations using automatic transmitter power control (ATPC) may be increased by a value corresponding to the ATPC range, up to a maximum of –7 dBW.

**US565** The following frequency bands in the range 275-1000 GHz are identified for passive service applications:

- Radio astronomy service: 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz, 453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;
- Earth exploration-satellite service (passive) and space research service (passive): 275-286 GHz, 296-306 GHz, 313-356 GHz, 361-365 GHz, 369-392 GHz, 397-399 GHz, 409-411 GHz, 416-434 GHz, 439-467 GHz, 477-502 GHz, 523-527 GHz, 538-581 GHz, 611-630 GHz, 634-654 GHz, 657-692 GHz, 713-718 GHz, 729-733 GHz, 750-754 GHz, 771-776 GHz, 823-846 GHz, 850-854 GHz, 857-862 GHz, 866-882 GHz, 905-928 GHz, 951-956 GHz, 968-973 GHz and 985-990 GHz.

The use of the range 275-1000 GHz by the passive services does not preclude use of this range by active services. This provision does not establish priority of use in the United States Table of Frequency Allocations, and does not preclude or constrain any active service use or future allocation of frequency bands in the 275-3000 GHz range.

## **Non-Federal Government (NG) Footnotes**

(These footnotes, each consisting of the letters “NG” followed by one or more digits, denote stipulations applicable only to non-Federal operations and thus appear solely in the non-Federal Table.)

**NG1** The band 535-1705 kHz is also allocated to the mobile service on a secondary basis for the distribution of public service information from Travelers Information Stations operating in accordance with the provisions of 47 CFR 90.242 on 10 kilohertz spaced channels from 540 kHz to 1700 kHz.

**NG2** Facsimile broadcasting stations may be authorized in the band 88-108 MHz.

**NG3** Control stations in the domestic public mobile radio service may be authorized frequencies in the band 72-73 and 75.4-76 MHz on the condition that harmful interference will not be caused to operational fixed stations.

**NG4** The use of the frequencies in the band 152.84-153.38 MHz may be authorized, in any area, to remote pickup broadcast base and mobile stations on the condition that harmful interference will not be caused to stations operating in accordance with the Table of Frequency Allocations.

**NG5** In the band 535-1705 kHz, AM broadcast licensees and permittees may use their AM carrier on a secondary basis to transmit signals intended for both broadcast and non-broadcast purposes. In the band 88-108 MHz, FM broadcast licensees and permittees are permitted to use subcarriers on a secondary basis to transmit signals intended for both broadcast and non-broadcast purposes. In the bands 54-72, 76-88, 174-216, 470-608, and 614-698 MHz, TV broadcast licensees and permittees are permitted to use subcarriers on a secondary basis for both broadcast and non-broadcast purposes. Use of the band 614-698 MHz is subject to the provisions specified in NG33.

**NG6** Stations in the public safety radio services authorized as of June 30, 1958, to use frequencies in the band 159.51-161.79 MHz in areas other than Puerto Rico and the Virgin Islands may continue such operation, including expansion of existing systems, on the condition that harmful interference will not be

caused to stations in the services to which these bands are allocated. In Puerto Rico and the Virgin Islands this authority is limited to frequencies in the band 160.05-161.37 MHz. No new public radio service system will be authorized to operate on these frequencies.

**NG7** In the bands 2000-2065, 2107-2170, and 2194-2495 kHz, fixed stations associated with the maritime mobile service may be authorized, for purposes of communication with coast stations, to use frequencies assignable to ship stations in these bands on the condition that harmful interference will not be caused to services operating in accordance with the Table of Frequency Allocations. *See* 47 CFR 80.371(a) for the list of available carrier frequencies.

**NG8** In the band 472-479 kHz, non-Federal stations in the maritime mobile service that were licensed or applied for prior to July 14, 2017 may continue to operate on a primary basis, subject to periodic license renewals.

**NG14** TV broadcast stations authorized to operate in the bands 54-72, 76-88, 174-216, 470-608, and 614-698 MHz may use a portion of the television vertical blanking interval for the transmission of telecommunications signals, on the condition that harmful interference will not be caused to the reception of primary services, and that such telecommunications services must accept any interference caused by primary services operating in these bands. Use of the band 614-698 MHz is subject to the provisions specified in NG33.

**NG16** In the bands 72-73 MHz and 75.4-76 MHz, frequencies may be authorized for mobile operations in the Industrial/Business Radio Pool, subject to not causing interference to the reception of broadcast television signals on channels 4 and 5.

**NG17** Stations in the land transportation radio services authorized as of May 15, 1958 to operate on the frequency 161.61 MHz may, upon proper application, continue to be authorized for such operation, including expansion of existing systems, on the condition that harmful interference will not be caused to the operation of any authorized station in the maritime mobile service. No new land transportation radio service system will be authorized to operate on 161.61 MHz.

**NG22** The frequencies 156.050 and 156.175 MHz may be assigned to stations in the maritime mobile service for commercial and port operations in the New Orleans Vessel Traffic Service (VTS) area and the frequency 156.250 MHz may be assigned to stations in the maritime mobile service for port operations in the New Orleans and Houston VTS areas.

**NG28** In Puerto Rico and the United States Virgin Islands, the band 160.86-161.4 MHz is available for assignment to remote pickup broadcast stations on a shared basis with stations in the Industrial/Business Pool.

**NG30** In Puerto Rico, the band 942-944 MHz is alternatively allocated to the fixed service (aural broadcast auxiliary stations).

**NG32** Frequencies in the bands 454.6625-454.9875 MHz and 459.6625-459.9875 MHz may be assigned to domestic public land and mobile stations to provide a two-way air-ground public radiotelephone service.

**NG33** In the band 614-698 MHz, the following provisions shall apply:

(a) Until July 13, 2020, stations in the broadcasting service and other authorized uses may operate as follows:

(1) Full power and Class A television (TV) stations, i.e., broadcast TV stations, may operate on a co-equal, primary basis with stations in the fixed and mobile services until such stations terminate operations on their pre-auction television channels in accordance with § 73.3700(b)(4).

(2) Low power TV (LPTV) and TV translator stations may operate on a secondary basis to stations in the fixed and mobile services and to broadcast TV stations, and fixed TV broadcast auxiliary stations may operate on a secondary basis to LPTV and TV translator stations, unless such stations are required to terminate their operations earlier in accordance with § 73.3700(g)(4) or § 74.602(h)(5)-(6).

(3) Low power auxiliary stations (LPAS), including wireless assist video devices (WAVDs), may operate on a secondary basis to all other authorized stations in accordance with § 74.802(f) and § 74.870(i).

(4) Unlicensed wireless microphones and white space devices (WSDs) may operate on a non-interference basis, unless such devices are required to terminate operations earlier in accordance with § 15.236(c)(2) or § 15.707(a)(1)-(2), (5), respectively.

(b) After July 13, 2020, only the following types of radiofrequency devices that are authorized in paragraph (a) may continue to operate:

(1) LPTV and TV translator stations may operate on a secondary basis to stations in the fixed and mobile services in the sub-bands 617-652 MHz and 663-698 MHz until required to terminate their operations in accordance with § 73.3700(g)(4).

(2) LPAS may operate in the sub-band 653-657 MHz and unlicensed wireless microphones may operate in the sub-bands 614-616 MHz and 657-663 MHz.

(3) WSDs may operate in: (i) the sub-bands 617-652 MHz and 663-698 MHz, except in those areas where their use is prohibited in accordance with §§ 15.707(a)(5) and 15.713(b)(2)(iv), and (ii) the sub-band 657-663 MHz, in accordance with § 15.707(a)(4).

**NG34** The bands 758-775 MHz and 788-805 MHz are available for assignment to the public safety services, as described in 47 CFR part 90.

**NG35** Frequencies in the bands 928-929 MHz, 932-932.5 MHz, 941-941.5 MHz, and 952-960 MHz may be assigned for multiple address systems and associated mobile operations on a primary basis.

**NG41** In the band 2120-2180 MHz, the following provisions shall apply to grandfathered stations in the fixed service:

(a) In the sub-band 2160-2162 MHz, authorizations in the Broadband Radio Service (BRS) applied for after January 16, 1992 shall be granted on a secondary basis to Advanced Wireless Services (AWS). In the band 2150-2162 MHz, all other BRS stations shall operate on a primary basis until December 9, 2021, and may continue to operate on a secondary basis thereafter, unless said facility is relocated in accordance with 47 CFR 27.1250 through 27.1255.

(b) In the sub-band 2160-2180 MHz, fixed stations authorized pursuant to 47 CFR part 101 may continue to operate on a secondary basis to AWS.

**NG50** In the band 10-10.5 GHz, non-Federal stations in the radiolocation service shall not cause harmful interference to the amateur service; and in the sub-band 10.45-10.5 GHz, these stations shall not cause harmful interference to the amateur-satellite service.

**NG51** In Puerto Rico and the United States Virgin Islands, the use of band 150.8-151.49 MHz by the fixed and land mobile services is limited to stations in the Industrial/Business Pool.

**NG52** Except as provided for by NG527A, use of the bands 10.7-11.7 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary satellites in the fixed-satellite service (FSS) shall be limited to international systems, *i.e.*, other than domestic systems.

**NG53** In the band 13.15-13.25 GHz, the following provisions shall apply:

(a) The sub-band 13.15-13.2 GHz is reserved for television pickup (TVPU) and cable television relay service (CARS) pickup stations inside a 50 km radius of the 100 television markets delineated in 47 CFR 76.51; and outside these areas, TVPU stations, CARS stations and non-geostationary satellite orbit fixed-satellite service (NGSO FSS) gateway earth stations shall operate on a co-primary basis.

(b) The sub-band 13.2-13.2125 GHz is reserved for TVPU stations on a primary basis and for CARS pickup stations on a secondary basis inside a 50 km radius of the 100 television markets delineated in 47 CFR 76.51; and outside these areas, TVPU stations and NGSO FSS gateway earth stations shall operate on a co-primary basis and CARS stations shall operate on a secondary basis.

(c) In the band 13.15-13.25 GHz, fixed television auxiliary stations licensed pursuant to applications accepted for filing before September 1, 1979, may continue operation, subject to periodic license renewals.

(d) In the sub-band 13.15-13.2125 GHz, NGSO FSS gateway uplink transmissions shall be limited to a maximum e.i.r.p. of 3.2 dBW towards 0° on the radio horizon.

NOTE: The above provisions shall not apply to geostationary satellite orbit (GSO) FSS operations in the band 12.75-13.25 GHz.

**NG56** In the bands 72-73 and 75.4-76 MHz, the use of mobile radio remote control of models is on a secondary basis to all other fixed and mobile operations. Such operations are subject to the condition that interference will not be caused to common carrier domestic public stations, to remote control of industrial equipment operating in the band 72-76 MHz, or to the reception of television signals on channels 4 (66-72 MHz) or 5 (76-82 MHz). Television interference shall be considered to occur whenever reception of regularly used television signals is impaired or destroyed, regardless of the strength of the television signal or the distance to the television station.

**NG57** The use of the band 12.75-13.25 GHz by non-geostationary-satellite systems in the fixed-satellite service is limited to communications with individually licensed earth stations.

**NG58** In the band 17.3-17.8 GHz, the following provisions shall apply to the broadcasting-satellite, fixed, and fixed-satellite services:

(a) The use of the band 17.3-17.8 GHz by the broadcasting-satellite and fixed-satellite (space-to-Earth) services is limited to geostationary satellites.

(b) The use of the band 17.3-17.8 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for broadcasting-satellite service.

(c) The use of the band 17.7-17.8 GHz by the broadcasting-satellite service is limited to receiving earth stations located outside of the United States and its insular areas.

(d) In the band 17.7-17.8 GHz, earth stations in the fixed-satellite service may be authorized for the reception of FSS emissions from geostationary satellites, subject to the condition that these earth stations shall not claim protection from transmissions of non-Federal stations in the fixed service that operate in that band.

**NG59** The frequencies 37.60 and 37.85 MHz may be authorized only for use by base, mobile, and operational fixed stations participating in an interconnected or coordinated power service utility system.

**NG60** In the band 31-31.3 GHz, for stations in the fixed service authorized after August 6, 2018, the unwanted emissions power in any 100 MHz of the 31.3-31.5 GHz Earth exploration-satellite service (passive) band shall be limited to -38 dBW (-38 dBW/100 MHz), as measured at the input to the antenna.

**NG62** In the bands 28.5-29.1 GHz and 29.25-29.5 GHz, stations in the fixed-satellite service shall not cause harmful interference to, or claim protection from, stations in the fixed service operating under the following call signs: KEB35, KGB72, KGC79, KIL20, KME49, KQG58, KQH74, KSA96, KSE73, KVB83, KYJ33, KZS88, WAX78, WLT380, WMK817, WML443, WMP367, and WSL69.

**NG63** In the band 37.5-40 GHz, earth station operations in the fixed-satellite service (space-to-Earth) shall not claim protection from stations in the fixed and mobile services, except where individually licensed earth stations are authorized pursuant to 47 CFR § 25.136.

**NG65** In the bands 24.75-25.25 GHz, 47.2-48.2 GHz, and 50.4-51.4 GHz, stations in the fixed and mobile services may not claim protection from individually licensed earth stations authorized pursuant to 47 CFR 25.136. However, nothing in this footnote shall limit the right of Upper Microwave Flexible Use Service licensees to operate in conformance with the technical rules contained in 47 CFR part 30. The Commission reserves the right to monitor developments and to undertake further action concerning interference between Upper Microwave Flexible Use Service and Fixed-Satellite Service, including aggregate interference to satellite receivers, if appropriate.

**NG66** The band 470-512 MHz (TV channels 14-20) is allocated to the broadcasting service on an exclusive

basis throughout the United States and its insular areas, except as described below:

(a) In the urbanized areas listed in the table below, the indicated frequency bands are allocated to the land mobile service on an exclusive basis for assignment to eligibles in the Public Mobile Services, the Public Safety Radio Pool, and the Industrial/Business Radio Pool, except that:

(1) Licensees in the land mobile service that are regulated as Commercial Mobile Radio Service (CMRS) providers may also use their assigned spectrum to provide fixed service on a primary basis.

(2) The use of the band 482-488 MHz (TV channel 16) is limited to eligibles in the Public Safety Radio Pool in or near (i) the Los Angeles urbanized area; and (ii) New York City; Nassau, Suffolk, and Westchester Counties in New York State; and Bergen County, NJ.

Urbanized area	Bands (MHz)	TV channels
Boston, MA.....	470-476, 482-488.....	14, 16
Chicago, IL-Northwestern IN.....	470-476, 476-482.....	14, 15
Cleveland, OH.....	470-476, 476-482.....	14, 15
Dallas-Fort Worth, TX.....	482-488.....	16
Detroit, MI.....	476-482, 482-488.....	15, 16
Houston, TX.....	488-494.....	17
Los Angeles, CA.....	470-476, 482-488, 506-512.....	14, 16, 20
Miami, FL.....	470-476.....	14
New York, NY-Northeastern NJ.....	470-476, 476-482, 482-488.....	14, 15, 16
Philadelphia, PA-NJ.....	500-506, 506-512.....	19, 20
Pittsburgh, PA.....	470-476, 494-500.....	14, 18
San Francisco-Oakland, CA.....	482-488, 488-494.....	16, 17
Washington, DC-MD-VA.....	488-494, 494-500.....	17, 18

(b) In the Gulf of Mexico offshore from the Louisiana-Texas coast, the band 476-494 MHz (TV channels 15-17) is allocated to the fixed and mobile services on a primary basis for assignment to eligibles in the Public Mobile and Private Land Mobile Radio Services.

(c) In Hawaii, the band 488-494 MHz (TV channel 17) is allocated exclusively to the fixed service for use by common carrier control and repeater stations for point-to-point inter-island communications only.

(d) The use of these allocations is further subject to the conditions set forth in 47 CFR parts 22 and 90.

**NG70** In Puerto Rico and the Virgin Islands only, the bands 159.240-159.435 and 160.410-160.620 MHz are also available for assignment to base stations and mobile stations in the special industrial radio service.

**NG92** The band 1900-2000 kHz is also allocated on a primary basis to the maritime mobile service in Regions 2 and 3 and to the radiolocation service in Region 2, and on a secondary basis to the radiolocation service in Region 3. The use of these allocations is restricted to radio buoy operations on the open sea and the Great Lakes. Stations in the amateur, maritime mobile, and radiolocation services in Region 2 shall be protected from harmful interference only to the extent that the offending station does not operate in compliance with the technical rules applicable to the service in which it operates.

**NG111** The band 157.4375-157.4625 MHz may be used for one way paging operations in the special emergency radio service.

**NG112** The frequencies 25.04, 25.08, 150.980, 154.585, 158.445, 159.480, 454.000 and 459.000 MHz may be authorized to stations in the Industrial/Business Pool for use primarily in oil spill containment and cleanup operations and secondarily in regular land mobile communication.

**NG115** In the bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz, and 614-698 MHz, wireless microphones and wireless assist video devices may be authorized on a non-interference basis, subject to the terms and conditions set forth in 47 CFR part 74, subpart H.

**NG118** In the bands 2025-2110 MHz, 6875-7125 MHz, and 12.7-13.25 GHz, television translator relay

stations may be authorized to use frequencies on a secondary basis to other stations in the Television Broadcast Auxiliary Service that are operating in accordance with the Table of Frequency Allocations.

**NG124** In the bands 30.85-34, 37-38, 39-40, 42-47.41, 150.995-156.25, 158.715-159.465, 453.0125-453.9875, 458.0125-458.9875, 460.0125-465.6375, and 467.9375-467.9875 MHz, police licensees are authorized to operate low power transmitters on a secondary basis in accordance with the provisions of 47 CFR 2.803 and 90.20(e)(5).

**NG141** In Alaska, the frequencies 42.4 MHz and 44.1 MHz are authorized on a primary basis for meteor burst communications by fixed stations in the Rural Radio Service operating under the provisions of 47 CFR part 22. In Alaska, the frequencies 44.2 MHz and 45.9 MHz are authorized on a primary basis for meteor burst communications by fixed private radio stations operating under the provisions of 47 CFR part 90. The private radio station frequencies may be used by Common Carrier stations on a secondary, noninterference basis and the Common Carrier frequencies may be used by private radio stations for meteor burst communications on a secondary, noninterference basis. Users shall cooperate to the extent practical to minimize potential interference. Stations utilizing meteor burst communications shall not cause harmful interference to stations of other radio services operating in accordance with the Table of Frequency Allocations.

**NG143** In the band 11.7-12.2 GHz, protection from harmful interference shall be afforded to transmissions from space stations not in conformance with ITU Radio Regulation No. 5.488 only if the operations of such space stations impose no unacceptable constraints on operations or orbit locations of space stations in conformance with No. 5.488.

**NG147** In the band 2483.5-2500 MHz, non-Federal stations in the fixed and mobile services that are licensed under 47 CFR parts 74, 90, or 101, which were licensed as of July 25, 1985, and those whose initial applications were filed on or before July 25, 1985, may continue to operate on a primary basis with the mobile-satellite and radiodetermination-satellite services, and in the sub-band 2495-2500 MHz, these grandfathered stations may also continue to operate on a primary basis with stations in the fixed and mobile except aeronautical mobile services that are licensed under 47 CFR part 27.

**NG148** The frequencies 154.585 MHz, 159.480 MHz, 160.725 MHz, 160.785 MHz, 454.000 MHz and 459.000 MHz may be authorized to maritime mobile stations for offshore radiolocation and associated telecommand operations.

**NG149** The bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-512 MHz, 512-608 MHz, and 614-698 MHz are also allocated to the fixed service to permit subscription television operations in accordance with 47 CFR part 73. Use of the band 614-698 MHz is subject to the provisions specified in NG33.

**NG152** The use of the band 219-220 MHz by the amateur service is limited to stations participating, as forwarding stations, in point-to-point fixed digital message forwarding systems, including intercity packet backbone networks.

**NG155** The bands 159.500-159.675 MHz and 161.375-161.550 MHz are allocated to the maritime service as described in 47 CFR part 80. Additionally, the frequencies 159.550, 159.575 and 159.600 MHz are available for low-power intership communications.

**NG159** In the band 698-806 MHz, stations authorized under 47 CFR part 74, subparts F and G may continue to operate indefinitely on a secondary basis to all other stations operating in that band.

**NG160** In the band 5895-5925 MHz, the use of the non-Federal mobile service is limited to operations in the Intelligent Transportation System radio service.

**NG164** The use of the band 18.6-18.8 GHz by the fixed-satellite service is limited to geostationary-satellite networks.

**NG165** In the bands 18.8-19.3 GHz and 28.6-29.1 GHz, geostationary-satellite networks in the fixed-



satellite service shall not cause harmful interference to, or claim protection from, non-geostationary-satellite systems in the fixed-satellite service.

**NG166** The use of the bands 19.4-19.6 GHz and 29.1-29.25 GHz by the fixed-satellite service is limited to feeder links for non-geostationary-satellite systems in the mobile-satellite service.

**NG169** After December 1, 2000, operations on a primary basis by the fixed-satellite service (space-to-Earth) in the band 3650-3700 MHz shall be limited to grandfathered earth stations. All other fixed-satellite service earth station operations in the band 3650-3700 MHz shall be on a secondary basis. Grandfathered earth stations are those authorized prior to December 1, 2000, or granted as a result of an application filed prior to December 1, 2000, and constructed within 12 months of initial authorization. License applications for primary operations for new earth stations, major amendments to pending earth station applications, or applications for major modifications to earth station facilities filed on or after December 18, 1998, and prior to December 1, 2000, shall not be accepted unless the proposed facilities are within 16.1 kilometers (10 miles) of an authorized primary earth station operating in the band 3650-3700 MHz. License applications for primary operations by new earth stations, major amendments to pending earth station applications, and applications for major modifications to earth station facilities, filed after December 1, 2000, shall not be accepted, except for changes in polarization, antenna orientation or ownership of a grandfathered earth station.

**NG171** In the band 6875-7125 MHz, the following two channels should be used for airborne TV pickup stations, wherever possible: 7075-7100 MHz and 7100-7125 MHz.

**NG172** In the band 7025-7075 MHz, the fixed-satellite service (space-to-Earth) is allocated on a primary basis, but the use of this allocation shall be limited to two grandfathered satellite systems. Associated earth stations located within 300 meters of the following locations shall be grandfathered: (a) In the band 7025-7075 MHz, Brewster, WA (48° 08' 46.7" N, 119° 42' 8.0" W); and (b) In the sub-band 7025-7055 MHz, Clifton, TX (31° 47' 58.5" N, 97° 36' 46.7" W) and Finca Pascual, PR (17° 58' 41.8" N, 67° 8' 12.6" W).

**NG173** In the band 216-220 MHz, secondary telemetry operations are permitted subject to the requirements of 47 CFR 90.259. After January 1, 2002, no new assignments shall be authorized in the sub-band 216-217 MHz.

**NG175** In the band 38.6-40 GHz, television pickup stations that were authorized on or before April 16, 2003, may continue to operate on a secondary basis to stations operating in accordance with the Table of Frequency Allocations.

**NG182** In the band 3700-4200 MHz, the following provisions shall apply:

(a) Except as provided in paragraph (c)(1), any currently authorized space stations serving the contiguous United States may continue to operate on a primary basis, but no applications for new space station authorizations or new petitions for market access shall be accepted for filing after June 21, 2018, other than applications by existing operators in the band seeking to make more efficient use of the band 4000-4200 MHz. Applications for extension, cancellation, replacement, or modification of existing space station authorizations in the band will continue to be accepted and processed normally.

(b) In areas outside the contiguous United States, the band 3700-4000 MHz is also allocated to the fixed-satellite service (space-to-Earth) on a primary basis.

(c) In the contiguous United States, i.e., the contiguous 48 states and the District of Columbia as defined by Partial Economic Areas Nos. 1-41, 43-211, 213-263, 265-297, 299-359, and 361-411, which includes areas within 12 nautical miles of the U.S. Gulf coastline (*see* § 27.6(m) of this chapter), the following provisions apply:

(1) Incumbent use of the fixed-satellite service (space-to-Earth) in the band 3700-4000 MHz is subject to the provisions of §§ 25.138, 25.147, 25.203(n) and part 27, subpart O of this chapter;

(2) Fixed service licensees authorized as of April 19, 2018, pursuant to part 101 of this chapter, must

self-relocate their point-to-point links out of the band 3700-4200 MHz by December 5, 2023;

(3) In the band 3980-4000 MHz, no new fixed or mobile operations will be permitted until specified by Commission rule, order, or notice.

**NG185** In the band 3650-3700 MHz, the use of the non-Federal fixed-satellite service (space-to-Earth) is limited to international inter-continental systems.

**NG338A** In the bands 1390-1395 MHz and 1427-1435 MHz, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the band 1400-1427 MHz:

(a) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.

(b) For stations in the mobile service (except for devices authorized by the FCC for the Wireless Medical Telemetry Service): -60 dBW/27 MHz.

**NG457A** Earth stations on vessels (ESVs), as regulated under 47 CFR part 25, are an application of the fixed-satellite service and the following provisions shall apply:

(a) In the band 3700-4200 MHz, ESVs may be authorized to receive FSS signals from geostationary satellites. ESVs in motion are subject to the condition that these earth stations may not claim protection from transmissions of non-Federal stations in the fixed and mobile except aeronautical mobile services. While docked, ESVs receiving in the band 4000-4200 MHz may be coordinated for up to 180 days, renewable. NG182 applies to incumbent licensees that provide service to ESVs in the band 3700-4000 MHz.

(b) In the band 5925-6425 MHz, ESVs may be authorized to transmit to geostationary satellites on a primary basis.

**NG527A** Earth Stations in Motion (ESIMs), as regulated under 47 CFR part 25, are an application of the fixed-satellite service (FSS) and the following provisions shall apply:

(a) In the bands 10.7-11.7 GHz, 19.3-19.4 GHz, and 19.6-19.7 GHz, ESIMs may be authorized for the reception of FSS emissions from geostationary and non-geostationary satellites, subject to the conditions that these earth stations may not claim protection from transmissions of non-Federal stations in the fixed service and that non-geostationary-satellite systems not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(b) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary satellites on a primary basis.

(c) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.4-28.6 GHz (Earth-to-space), and 29.5-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with non-geostationary satellites, subject to the condition that non-geostationary-satellite systems may not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(d) In the band 17.8-18.3 GHz, ESIMs may be authorized for the reception of FSS emissions from geostationary and non-geostationary satellites on a secondary basis, subject to the condition that non-geostationary-satellite systems not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(e) In the bands 18.8-19.3 GHz (space to Earth), and 28.6-29.1 GHz (Earth to space), ESIMs may be authorized to communicate with geostationary and non-geostationary satellites, subject to the condition that geostationary-satellite networks may not cause unacceptable interference to, or claim protection from, non-geostationary satellite systems in the fixed-satellite service.

(f) In the band 17.3-17.8 GHz, ESIMs may be authorized for the reception of FSS emissions from geostationary satellites on an unprotected basis.

**NG535A** The use of the band 29.25-29.5 GHz by the fixed-satellite service is limited to geostationary-satellite networks and to feeder links for non-geostationary-satellite systems in the mobile-satellite service.

## Federal Government (G) Footnotes

(These footnotes, each consisting of the letter “G” followed by one or more digits, denote stipulations applicable only to Federal operations and thus appear solely in the Federal Table.)

**G2** In the bands 216.965-216.995 MHz, 420-450 MHz (except as provided for in G129), 890-902 MHz, 928-942 MHz, 1300-1390 MHz, 2310-2390 MHz, 2417-2450 MHz, 2700-2900 MHz, 3300-3500 MHz, 5650-5925 MHz, and 9000-9200 MHz, use of the Federal radiolocation service is restricted to the military services.

**G5** In the bands 162.0125-173.2, 173.4-174, 406.1-410 and 410-420 MHz, use by the military services is limited by the provisions specified in the channeling plans shown in Sections 4.3.7 and 4.3.9 of the NTIA Manual.

**G6** Military tactical fixed and mobile operations may be conducted nationally on a secondary basis: (a) To the meteorological aids service in the band 403-406 MHz; and (b) To the radio astronomy service in the band 406.1-410 MHz. Such fixed and mobile operations are subject to local coordination to ensure that harmful interference will not be caused to the services to which the bands are allocated.

**G8** Low power Federal radio control operations are permitted in the band 420-450 MHz.

**G11** Federal fixed and mobile radio services, including low power radio control operations, are permitted in the band 902-928 MHz on a secondary basis.

**G15** Use of the band 2700-2900 MHz by the military fixed and shipborne air defense radiolocation installations will be fully coordinated with the meteorological aids and aeronautical radionavigation services. The military air defense installations will be moved from the band 2700-2900 MHz at the earliest practicable date. Until such time as military air defense installations can be accommodated satisfactorily elsewhere in the spectrum, such operations will, insofar as practicable, be adjusted to meet the requirements of the aeronautical radionavigation service.

**G19** Use of the band 9000-9200 MHz by military fixed and shipborne air defense radiolocation installations will be fully coordinated with the aeronautical radionavigation service, recognizing fully the safety aspects of the latter. Military air defense installations will be accommodated ultimately out-side this band. Until such time as military defense installations can be accommodated satisfactorily elsewhere in the spectrum such operations will, insofar as practicable, be adjusted to meet the requirements of the aeronautical radionavigation services.

**G27** In the bands 225-328.6 MHz, 335.4-399.9 MHz, and 1350-1390 MHz, the fixed and mobile services are limited to the military services.

**G30** In the bands 138-144 MHz, 148-149.9 MHz, and 150.05-150.8 MHz, the fixed and mobile services are limited primarily to operations by the military services.

**G32** Except for weather radars on meteorological satellites in the band 9.975-10.025 GHz and for Federal survey operations (see footnote US108), Federal radiolocation in the band 10-10.5 GHz is limited to the military services.

**G34** In the band 34.4-34.5 GHz, weather radars on board meteorological satellites for cloud detection are authorized to operate on the basis of equality with military radiolocation devices. All other non-military radiolocation in the band 33.4-36.0 GHz shall be secondary to the military services.

**G42** The space operation service (Earth-to-space) is limited to the band 1761-1842 MHz, and is limited to space command, control, range and range rate systems.

**G56** Federal radiolocation in the bands 1215-1300, 2900-3100, 5350-5650 and 9300-9500 MHz is primarily for the military services; however, limited secondary use is permitted by other Federal agencies in support of experimentation and research programs. In addition, limited secondary use is permitted for

survey operations in the band 2900-3100 MHz.

**G59** In the bands 902-928 MHz, 3100-3300 MHz, 3500-3650 MHz, 5250-5350 MHz, 8500-9000 MHz, 9200-9300 MHz, 13.4-14.0 GHz, 15.7-17.7 GHz and 24.05-24.25 GHz, all Federal non-military radiolocation shall be secondary to military radiolocation, except in the sub-band 15.7-16.2 GHz airport surface detection equipment (ASDE) is permitted on a co-equal basis subject to coordination with the military departments.

**G100** The bands 235-322 MHz and 335.4-399.9 MHz are also allocated on a primary basis to the mobile-satellite service, limited to military operations.

**G104** In the bands 7450-7550 and 8175-8215 MHz, it is agreed that although the military space radio communication systems, which include earth stations near the proposed meteorological-satellite installations will precede the meteorological-satellite installations, engineering adjustments to either the military or the meteorological-satellite systems or both will be made as mutually required to assure compatible operations of the systems concerned.

**G109** All assignments in the band 157.0375-157.1875 MHz are subject to adjustment to other frequencies in this band as long term U.S. maritime VHF planning develops, particularly that planning incident to support of the National VHF-FM Radiotelephone Safety and Distress System (See Doc. 15624/1-1.9.111/1.9.125).

**G110** Federal ground-based stations in the aeronautical radionavigation service may be authorized between 3500-3650 MHz when accommodation in the band 2700-2900 MHz is not technically and/or economically feasible.

**G114** The band 1369.05-1390 MHz is also allocated to the fixed-satellite service (space-to-Earth) and to the mobile-satellite service (space-to-Earth) on a primary basis for the relay of nuclear burst data.

**G115** In the band 13 360-13 410 kHz, the fixed service is allocated on a primary basis outside the conterminous United States. Within the conterminous United States, assignments in the fixed service are permitted, and will be protected for national defense purposes or, if they are to be used only in an emergency jeopardizing life, public safety, or important property under conditions calling for immediate communication where other means of communication do not exist.

**G116** The band 7125-7155 MHz is also allocated for Earth-to-space transmissions in the Space Operations Service at a limited number of sites (not to exceed two), subject to established coordination procedures.

**G117** In the bands 7.25-7.75 GHz, 7.9-8.4 GHz, 17.375-17.475 GHz, 17.6-21.2 GHz, 30-31 GHz, 33-36 GHz, 39.5-41 GHz, 43.5-45.5 GHz and 50.4-51.4 GHz, the Federal fixed-satellite and mobile-satellite services are limited to military systems.

**G120** Development of airborne primary radars in the band 2360-2390 MHz with peak transmitter power in excess of 250 watts for use in the United States is not permitted.

**G122** In the bands 2300-2310 MHz, 2395-2400 MHz, 2400-2417 MHz, and 4940-4990 MHz, Federal operations may be authorized on a non-interference basis to authorized non-Federal operations, and shall not constrain the implementation of any non-Federal operations.

**G127** Federal Travelers Information Stations (TIS) on 1610 kHz have co-primary status with AM Broadcast assignments. Federal TIS authorized as of August 4, 1994, preclude subsequent assignment for conflicting allotments.

**G128** Use of the band 56.9-57 GHz by inter-satellite systems is limited to transmissions between satellites in geostationary orbit, to transmissions between satellites in geostationary satellite orbit and those in high-Earth orbit, to transmissions from satellites in geostationary satellite orbit to those in low-Earth orbit, and to transmissions from non-geostationary satellites in high-Earth orbit to those in low-Earth orbit. For links between satellites in the geostationary satellite orbit, the single entry power flux-density at all altitudes from 0 km to 1000 km above the Earth's surface, for all conditions and for all methods of modulation, shall not

exceed  $-147$  dB (W/m<sup>2</sup>/100 MHz) for all angles of arrival.

**G129** Federal wind profilers are authorized to operate on a primary basis in the radiolocation service in the frequency band 448-450 MHz with an authorized bandwidth of no more than 2 MHz centered on 449 MHz, subject to the following conditions: 1) wind profiler locations must be pre-coordinated with the military services to protect fixed military radars; and 2) wind profiler operations shall not cause harmful interference to, nor claim protection from, military mobile radiolocation stations that are engaged in critical national defense operations.

**G130** Federal stations in the radiolocation service operating in the band 5350-5470 MHz, shall not cause harmful interference to, nor claim protection from, Federal stations in the aeronautical radionavigation service operating in accordance with ITU Radio Regulation No. 5.449.

**G131** Federal stations in the radiolocation service operating in the band 5470-5650 MHz, with the exception of ground-based radars used for meteorological purposes operating in the band 5600-5650 MHz, shall not cause harmful interference to, nor claim protection from, Federal stations in the maritime radionavigation service.

**G132** Use of the radionavigation-satellite service in the band 1215-1240 MHz shall be subject to the condition that no harmful interference is caused to, and no protection is claimed from, the radionavigation service authorized under ITU Radio Regulation No. 5.331. Furthermore, the use of the radionavigation-satellite service in the band 1215-1240 MHz shall be subject to the condition that no harmful interference is caused to the radiolocation service. ITU Radio Regulation No. 5.43 shall not apply in respect of the radiolocation service. ITU Resolution 608 (Rev.WRC-15) shall apply.

**G134** In the band 7190-7235 MHz, Federal earth stations operating in the meteorological-satellite service (Earth-to-space) may be authorized subject to the following conditions:

- (a) Earth stations are limited to those communicating with the Department of Commerce Geostationary Operational Environmental Satellites (GOES).
- (b) There shall not be more than five earth stations authorized at one time.
- (c) The GOES satellite receiver shall not claim protection from existing and future stations in the fixed service (ITU Radio Regulation No. 5.43A does not apply).

## **4.2 FREQUENCY ALLOTMENTS**

### **4.2.1 Allotment of 27575 and 27585 kHz for Short-Distance Low-Power Service**

1. These allotments are to provide for intermittent miscellaneous U.S. Government short-distance low-power radio communications, radio signaling, and the control of remote objects or devices by means of radio (where the radiated power exceeds the limit established under Section 7.9).

2. The designated frequencies are allotted for use by U.S. Government agencies and may be authorized for use by agencies as required upon application. All stations operating on these frequencies shall meet the conditions and standards established for this service.

3. The designated frequencies are available on a shared basis only and will not be authorized for exclusive use of any one agency. No protection from interference can be assured to any station operating in this service. Services involving safety of life and property should not employ these frequencies in view of their unprotected status. All transmissions are to be restricted to official U.S. Government business that requires the use of radio.

4. Stations in this service shall utilize FCC type-accepted or type-approved Citizens Radio Band equipment or the equivalent. The maximum transmitter output power shall be five watts.

5. Stations shall be identified in accordance with the regulations of each agency.

6. The only class of station authorized is Mobile (including portable-type operation).

7. Frequencies 27575 and 27585 kHz with 6KA2A, 6KA2D and 6KA3E emission are designated for

the U.S. Government short-distance low-power radio service.

8. All applications for the use of these frequencies must bear the note S159 which reads, “U.S. Government short-distance low-power service.”

#### **4.2.2 Allotments in the Band 1755-1850 MHz for Fixed Security Surveillance Systems**

The frequencies 1760, 1780, and 1800 MHz are allotted for use in fixed security surveillance systems, on a secondary basis to other stations operating in accordance with the Federal Table of Frequency Allocations.

#### **4.2.3 Allotments for Wide-Area, Common-Use Frequencies**

1. Wide-Area, Common-Use frequencies are allotted for use by all federal agencies and are to provide for radio communications that do not justify the assigning of a radio frequency exclusively to that use, i.e., the frequency can be shared with other users.

a. The following paired frequencies are to be used for wide-area (e.g., county-wide, state-wide, USA or USP) operations of a transient nature that require the use of a repeater station. Unpaired, single frequency operations will be permitted on the repeater transmit frequencies and on the repeater receive frequencies only if all other wide-area, common-use frequencies are in use, but only upon showing that none of the unpaired frequencies in subparagraph b., below, are available.

<b>Frequencies (MHz)</b>	
<b>Repeater Transmit</b>	<b>Repeater Receive</b>
163.100	168.350
409.050	418.050
409.3375	418.3375

The frequencies 409.05 and 409.3375 MHz shall not be used in the U.S./Canada Border Areas unless prior coordination has been effected with Canada under the provisions of paragraphs 3.9 and 3.10 of Section 3.4.7 of this Manual, or the output power is 5 watts or less and interference does not occur to Canadian operations.

b. The following frequencies are to be used only for wide-area (e.g., county-wide, state-wide, USA or USP) operations of a transient nature that do not require the use of a repeater station, and shall be used in a simplex mode (use of a base station is allowed):

<b>Frequencies (MHz)</b>	
412.825	412.8375
412.850	412.8625

2. All operations shall be authorized in accordance with Chapter 9 of this Manual. The frequencies are available on a shared, non-priority basis only, and will not be authorized for, nor are they intended for, the exclusive use of any one agency. No protection from interference will be provided to any station operating on these frequencies from other stations operating on the same frequency. The use of equipment with coded squelch is strongly encouraged to reduce nuisance interference from other users.

3. These allotments are for use by federal stations in the Land and Maritime Mobile Services (Table of Services, Station Classes, and Stations, Chapter 6, Section 6.1.4 of this Manual refers), and the following restrictions apply.

- The minimum ERP necessary to support the intended use shall be employed;
- The maximum base or mobile station transmitter output power shall not exceed 30 watts;
- The gain of the base station (or repeater station) antenna shall not exceed 6 dBi;
- The height of the base station (or repeater station) antenna shall not exceed 6 meters above the

height of the structure supporting the antenna;

e. All equipment shall conform to Section 5.3 of this Manual;

4. Applications for assignments on the frequencies listed in subparagraphs 1.a. and 1.b., above, shall be affixed with Record Note S355, "This assignment is for a wide-area, common-use frequency pursuant to Section 4.2.3 of the NTIA Manual."

#### **4.2.4 Allotments for Local-Area, Common-Use Frequencies**

1. Local-Area, Common-Use frequencies are allotted for use by all federal agencies and are to provide for radio communications that do not justify the assigning of a radio frequency exclusively to that use, i.e., the frequency can be shared with other users.

a. The following paired frequencies are to be used only for local area operations requiring the use of a repeater station at a fixed location. Unpaired, single frequency operations will be permitted on the repeater transmit frequencies, and on the repeater receive frequencies, only if all other local-area, common-use frequencies are in use, but only upon showing that none of the unpaired frequencies in subparagraph b., below, are available:

<b>Frequencies (MHz)</b>	
<b>Repeater Transmit</b>	<b>Repeater Receive</b>
173.625	167.1375
407.525	416.525
409.075	418.075

The frequency 409.075 MHz shall not be used in the U.S./Canada Border Areas unless prior coordination has been effected with Canada under the provisions of paragraphs 3.9 and 3.10 of Section 3.4.7 of this Manual, or the output power is 5 watts or less and interference does not occur to Canadian operations.

b. The following frequencies shall be used only for local area operations that do not require the use of a repeater station, and shall be used only in a simplex mode (use of base stations is allowed):

<b>Frequencies (MHz)</b>	
168.6125	163.7125
412.875	412.8875
412.9	412.9125

2. All operations shall be authorized in accordance with Chapter 9 of this Manual. The frequencies are available on a shared, non-priority basis only, and will not be authorized for, nor are they intended, for the exclusive use of any one agency. No protection from interference will be provided to any station operating on these frequencies from other stations operating on the same frequency. The use of equipment with coded squelch is strongly encouraged to reduce nuisance interference from other users.

3. These allotments are for use by federal stations in the Land and Maritime Mobile Services (Table of Services, Station Classes, and Stations, Chapter 6, Section 6.1.4 of this Manual refers), and the following restrictions apply.

- a. The minimum ERP necessary to support the intended use shall be employed;
- b. The maximum base or mobile station transmitter output power shall not exceed 30 watts;
- c. The gain of the base station (or repeater station) antenna shall not exceed 6 dBi;
- d. The height of the base station (or repeater station) antenna shall not exceed 6 meters above the height of the structure supporting the antenna;
- e. All equipment shall conform to Section 5.3 of this Manual;
- f. Radius of operation for mobile stations is limited to 50 kilometers.

4. Applications for assignments on the frequencies listed in subparagraphs 1.a. and 1.b., above, shall be

affixed with Record Note S356, “This assignment is for a local-area, common-use frequency pursuant to Section 4.2.4 of the NTIA Manual.”

## 4.3 FREQUENCY PLANS

### 4.3.1 CW Phase Comparison Radiolocation Plan

1. This plan provides for the use of frequencies for low power, medium and high frequency radiolocation systems employing harmonically related N0N emission phase comparison frequencies and associated 1KA2D emission data link frequencies. These systems normally operate to distances of approximately 400 kilometers offshore and to considerably lesser distances inland.

2. The following phase comparison frequencies with N0N emission are available for assignment in all areas. Frequency assignments for a band of frequencies shall not be made. Where equipment or other limitations make it impracticable to operate on these channels, applications for other suitable frequencies will be considered on a case-by-case basis.

1650.0-1655.0 kHz					3300.4-3310.4 kHz				
1650.0	1651.0	1652.0	1653.0	1654.0	3300.4	3302.4	3304.4	3306.4	3308.4
1650.1	1651.1	1652.1	1653.1	1654.1	3300.6	3302.6	3304.6	3306.6	3308.6
1650.2	1651.2	1652.2	1653.2	1654.2	3300.8	3302.8	3304.8	3306.8	3308.8
1650.3	1651.3	1652.3	1653.3	1654.3	3301.0	3303.0	3305.0	3307.0	3309.0
1650.4	1651.4	1652.4	1653.4	1654.4	3301.2	3303.2	3305.2	3307.2	3309.2
1650.5	1651.5	1652.5	1653.5	1654.5	3301.4	3303.4	3305.4	3307.4	3309.4
1650.6	1651.6	1652.6	1653.6	1654.6	3301.6	3303.6	3305.6	3307.6	3309.6
1650.7	1651.7	1652.7	1653.7	1654.7	3301.8	3303.8	3305.8	3307.8	3309.8
1650.8	1651.8	1652.8	1653.8	1654.8	3302.0	3304.0	3306.0	3308.0	3310.0
1650.9	1651.9	1652.9	1653.9	1654.9	3302.2	3304.2	3306.2	3308.2	3310.2
				1655.0					3310.4

3. The assignment of suitable frequencies for the associated data links with 1KA2D emission shall be considered on a case-by-case basis.

4. The mean antenna power shall be limited to 100 watts for both N0N and 1KA2D emissions. Only radiolocation land stations and radiolocation mobile stations shall be authorized.5. The designated frequencies shall be authorized on a shared non-priority basis only and shall not be authorized for the exclusive use of any one agency. Any harmful interference that may develop between authorized radiolocation operations shall be resolved locally by coordination between the users involved.

5. Frequency assignments shall be for a temporary period not to exceed two years, and may be renewed.

### 4.3.2 Plan for Wireless Microphones in the Band 162-174 MHz

1. The following channels have been allotted for use by wireless microphone systems under the conditions listed in (a) through (e) below:

169.445 MHz	171.045 MHz
169.505 MHz	171.105 MHz
170.245 MHz	171.845 MHz
170.305 MHz	171.905 MHz

- The emission bandwidth shall not exceed 54 kHz.
- The output power shall not exceed 50 milliWatts.
- The frequency stability of wireless microphones shall limit the total emission to within 32.5 kHz of the assigned frequency.
- All wireless microphone use will be on an unprotected basis and further will be on a non-



interference basis to authorized federal and non-federal users with the exception of other wireless microphone users.

e. Assignment applications for wireless microphone use will be considered on a case-by-case basis by the Frequency Assignment Subcommittee (FAS); and, assignment applications do not need to be coordinated with the Hydrology Subcommittee.

#### **4.3.3 Plan for Hydrologic and Meteorological Operations in the Bands 162-174 and 406.1-420 MHz**

1. Hydrologic Channels. This plan identifies the center frequencies of channels used primarily for hydrologic operations

<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>
169.425	170.2625	171.1000	406.1250
169.4375	170.2750	171.1125	406.1750
169.4500	170.2875	171.1250	412.6625
169.4625	170.3000	171.8250	412.675
169.4750	170.3125	171.8375	412.6875
169.4875	170.3250	171.8500	412.7125
169.5000	171.025	171.8625	412.7250
169.5125	171.0375	171.8750	412.7375
169.5250	171.0500	171.8875	412.7625
170.2250	171.0625	171.9000	412.775
170.2375	171.0750	171.9125	415.1250
170.2500	171.0875	171.9250	415.1750

a. Use by Federal Agencies.

Federal agencies may use the frequencies listed in the table above only for hydrologic operations, except as indicated in Section 8.3.6 of this Manual.

b. Use by non-Federal agencies. As provided in Allocation footnote US13, non-federal fixed stations may use the frequencies listed in the table above for the specific purpose of transmitting hydrologic and meteorological data in cooperation with agencies of the Federal Government.

c. Coordination. agencies must coordinate with the Hydrology Subcommittee of the Federal Interagency Advisory Committee on Water Data, as prescribed in Section 8.3.6 of this Manual, when applying for an assignment on one of the frequencies listed in the table above.

d. Narrowband Hydrologic Operations. All new hydrologic systems are required to operate with a necessary bandwidth of less than 12.5 kHz, and may use all the frequencies shown in the table above.

e. Wideband Hydrologic Operations.

Existing systems authorized in the 162-174 MHz band may continue using equipment operating with necessary bandwidths equal to, or greater than, 12.5 kHz, using the center frequencies listed in the table above that are spaced 25 kHz apart and in the columns beginning with 169.425, 170.2625, and 171.1000 MHz. New operations must have narrowband equipment operating with a necessary bandwidth of less than 12.5 kHz. All hydrologic systems in the 406.1-420 MHz band must comply with the center frequencies listed in the table above, and new operations must have equipment operating with necessary bandwidths of less than 12.5 kHz. New assignments on frequencies 406.1250 and 406.1750 MHz are to be primarily for paired operations with frequencies 415.1250 and 415.1750 MHz, respectively.

2. Meteorological and Quasi-Hydrologic Operations. The frequency 171.175 MHz is allotted for meteorological and quasi-hydrologic operations. Coordination with the Hydrology Subcommittee is not required.

#### 4.3.4 Telemetry Plans

1. For the band 1435-1535 MHz

a. Ninety-nine one-megahertz channels are designated for use for telemetry and associated telecommand during the flight testing of manned or unmanned aircraft, missiles, or major components thereof (Station Classes MOEA, FLEA, MOD, FLD--see Chapter 6 for definitions).

b. All assignments will be centered on frequencies at standard intervals of 1 MHz, beginning at 1435.5 MHz, and will be authorized bandwidths of 1, 3, or 5 MHz. Assignments with bandwidths greater than 1 MHz will be centered so that they do not extend outside the allocated band.

c. The frequencies 1444.5, 1453.5, 1501.5, 1515.5, 1524.5 and 1525.5 MHz will be shared with flight telemetry mobile stations (Station Classes MOEB, FLEB, MOD, FLD--see Chapter 6). Such uses will be limited to 1 MHz bandwidths except for frequencies 1524.5 and 1525.5 MHz where a bandwidth up to 2 MHz is permitted.

d. Included as permissible use of the 1435-1535 MHz band is telemetry associated with launching and reentry into the Earth's atmosphere, as well as any incidental orbiting prior to reentry, of manned or unmanned objects undergoing flight tests (Station Classes MOEA, FLEA, MOD, FLD apply).

e. Telecommand stations authorized operation in the 1435-1535 MHz band will:

- (1) Directly support flight test aeronautical telemetry functions;
- (2) Be limited to 1 MHz bandwidth; and,
- (3) Use antennas having a half power beamwidth of no more than 8 degrees and a front-to-back ratio of at least 20 dB.

f. In the band 1435-1535 MHz, the channels designated for aeronautical telemetry are also available for space telemetry on a shared basis.

2. For the band 2200-2300 MHz

a. In the band 2200-2290 MHz, 90 one-megahertz narrowband channels are designated, centered on 2200.5 MHz and each 1-megahertz increment thereafter, through and including 2289.5 MHz. The use of emission bandwidths greater than 1 MHz is permitted, provided the assigned frequencies are centered on the center frequencies of narrowband channels. These channels are available for a) telemetry from space research space stations irrespective of their trajectories and b) aeronautical telemetry, including telemetry associated with launch vehicles, missiles, and upper atmosphere research rockets. Such use is on a coequal shared basis with fixed and mobile line-of-sight operations in the band conducted in accordance with the Federal Table of Frequency Allocations. No provision is made in this band for the flight testing of manned aircraft.

b. In the band 2290-2300 MHz, no specific channels have been established.

3. For the band 2310-2395 MHz--The following applies to Mobile Telemetry and Associated Telecommand:

a. Seventy-three 1-megahertz channels are designated for use for telemetry and associated telecommand during the flight testing of manned or unmanned aircraft, missiles, or major components thereof (Station Classes MOEA, FLEA, MOD, FLD--see Chapter 6 for definitions).

b. All assignments will be centered on frequencies at standard intervals of 1 MHz, beginning at 2310.5 MHz, and will normally be authorized bandwidths of 1, 3, or 5 MHz. Wider bandwidths may be authorized on a case-by-case basis to equipment capable of tuning the entire band. Assignments with bandwidths greater than 1 MHz will be centered so that they do not extend outside the allocated band. Telecommand assignments will be limited to 1 MHz bandwidths (see 3.d below)

c. The frequencies 2312.5, 2332.5, 2352.5, 2364.5, 2370.5, and 2382.5 MHz are also designated for use by both federal and non-federal stations on a co-equal basis for telemetry and associated telecommand operations of expendable and re-usable launch vehicles whether or not such operations involve flight testing. Such uses will be limited to 1 MHz bandwidths. (Station classes MOEA, MOEB, MOD, FLEA, FLEB, and FLD apply).

d. Telecommand stations, except as noted in 3c, above, authorized operation in the 2310-2390 MHz band will:

- (1) Directly support flight test aeronautical telemetering functions;
- (2) Be limited to 1 MHz bandwidth; and,
- (3) Use antennas having a half power beamwidth of no more than 8 degrees and a front-to-back ratio of at least 20 dB.

#### **4.3.5 VHF/UHF Plan for Aeronautical Radionavigation**

1. TACAN-DME and VOR comprise the short-distance air navigational system in the common civil/military National Airspace System (NAS). TACAN is capable of providing range and azimuth information to aircraft. Normally range-only information is received by civil aircraft. DME provides range only and VOR provides azimuth only.

2. Frequencies at 1-MHz increments in the 960-1215 MHz band are used in airborne interrogating and ground transponder equipment as shown in the channel arrangement depicted below. This channel-pairing arrangement, which has been adopted by ICAO for facilities supporting operations in the international aeronautical service, also serves as a basis for all frequency planning and assignments for the NAS. TACAN and DME frequencies are designated on aeronautical charts by channel numbers 1-126. TACAN channels in the National Airspace System plan are paired with VOR or ILS localizer frequencies in the 108-118 MHz band and with glide slope frequencies in the 328.6-335.4 MHz band, as shown. This pairing arrangement facilitates the employment of a VOR in conjunction with a TACAN-DME beacon to form a VORTAC facility to provide simultaneous azimuth and range information to civil aircraft. Similarly TACAN-DME beacons may be paired with ILS facilities to provide both range and terminal guidance (azimuth and glide slope) information to properly equipped aircraft.

3. When a TACAN or DME transponder is intended to operate in association with a VHF navigational facility (VOR or ILS), the transponder is collocated with the VHF facility and frequency paired with it. If the system is to be used for terminal services such as for airport approach or landing, the facilities are considered to be collocated only if the transponder and VHF antennas are not more than 260 feet (80 meters) apart. For enroute procedures, collocation is considered to exist if the antenna separation does not exceed 2,000 feet (610 meters). Where the separation exceeds these figures, a VOR/ILS frequency from one pair and the TACAN-DME frequency from another pair must be assigned and suitable notations made on aeronautical charts to alert the user that he is not receiving azimuth and range information from the same point.

4. TACAN channels 17-59 and 70-126 are designated for use in the National Airspace System. Frequency assignments on these channels and for VOR and ILS operations are managed by the Aeronautical Assignment Group (AAG) of the FAS, under the provisions of Sections 1.3.2 and 9.14.1. Most of these TACAN channels are used by the FAA to provide air navigation services.

5. Channels 1-16 and 60-69 are designated for the military services for tactical uses and are not used in the NAS. The frequency subbands matching these channel designators are assigned to the military departments for use throughout the U. S. and Possessions. Assignments of specific frequencies to areas and locations are accomplished by individual military departments after appropriate coordination between departments. Land and shipborne beacons operating on these channels, as well as airborne beacons for air-to-air operations provide both azimuth and range information to military aircraft.

6. The FAA recognizes the need of the military services to use NAS frequencies for tactical purposes, including air-to-air operations, on a secondary basis. The military services recognize the need for frequency adjustments to provide protection for new or reclassified facilities of the NAS. Assignments and adjustments in support of these facilities shall be coordinated on a case-by-case basis through the AAG.

7. To minimize the possibility of harmful interference between the NAS and military operations, the FAA shall make every effort to avoid the use of TACAN Channels 17, 59, and 70 in areas of concentrated fleet activity. The military services shall coordinate in advance with the FAA relative to the use of TACAN Channels 16, 60, and 69 for land-based facilities.

8. Assignments of TACAN channels in the operational environment of ground radar facilities equipped with Selective Identification Features (SIF) of Secondary Surveillance Radars (SSR) must be considered

carefully, in order to avoid interference. The ground SIF/SSR interrogator transmits on 1030 MHz (TACAN Channel 6 interrogator frequency) and the airborne SIF/SSR transponder transmits on 1090 MHz (TACAN Channel 66 interrogator frequency).

Channel	VOR MHz	DME/TACAN				ILS	
		Airborne		Ground			
		Int. Freq. MHz	Pulse Code <i>usec</i>	Reply Freq. MHz	Pulse Code <i>usec</i>	Localizer MHz	Glide Slope MHz
1X		1025	12	962	12		
1Y		1025	36	1088	30		
2X		1026	12	963	12		
2Y		1026	36	1089	30		
3X		1027	12	964	12		
3Y		1027	36	1090	30		
4X		1028	12	965	12		
4Y		1028	36	1091	30		
5X		1029	12	966	12		
5Y		1029	36	1092	30		
6X		1030	12	967	12		
6Y		1030	36	1093	30		
7X		1031	12	968	12		
7Y		1031	36	1094	30		
8X		1032	12	969	12		
8Y		1032	36	1095	30		
9X		1033	12	970	12		
9Y		1033	36	1096	30		
10X		1034	12	971	12		
10Y		1034	36	1097	30		
11X		1035	12	972	12		
11Y		1035	36	1098	30		
12X		1036	12	973	12		
12Y		1036	36	1099	30		
13X		1037	12	974	12		
13Y		1037	36	1100	30		
14X		1038	12	975	12		
14Y		1038	36	1101	30		
15X		1039	12	976	12		
15Y		1039	36	1102	30		
16X		1040	12	977	12		
16Y		1040	36	1103	30		
17X	108.00	1041	12	978	12		
17Y	108.05	1041	36	1104	30		
18X		1042	12	979	12	108.10	334.70
18Y		1042	36	1105	30	108.15	334.55
19X	108.20	1043	12	980	12		
19Y	108.25	1043	36	1106	30		
20X		1044	12	981	12	108.3	334.1
20Y		1044	36	1107	30	108.35	333.95
21X	108.40	1045	12	982	12		
21Y	108.45	1045	36	1108	30		

Channel	VOR MHz	DME/TACAN				ILS	
		Airborne		Ground			
		Int. Freq. MHz	Pulse Code <i>usec</i>	Reply Freq. MHz	Pulse Code <i>usec</i>	Localizer MHz	Glide Slope MHz
22X		1046	12	983	12	108.5	329.9
22Y		1046	36	1109	30	108.55	329.75
23X	108.6	1047	12	984	12		
23Y	108.65	1047	36	1110	30		
24X		1048	12	985	12	108.70	330.50
24Y		1048	36	1111	30	108.75	330.35
25X	108.80	1049	12	986	12		
25Y	108.85	1049	36	1112	30		
26X		1050	12	987	12	108.90	329.30
26Y		1050	36	1113	30	108.95	329.15
27X	109.00	1051	12	988	12		
27Y	109.05	1051	36	1114	30		
28X		1052	12	989	12	109.10	331.40
28Y		1052	36	1115	30	109.15	331.25
29X	109.20	1053	12	990	12		
29Y	109.25	1053	36	1116	30		
30X		1054	12	991	12	109.30	332.00
30Y		1054	36	1117	30	109.35	331.85
31X	109.40	1055	12	992	12		
31Y	109.45	1055	36	1118	30		
32X		1056	12	993	12	109.50	332.60
32Y		1056	36	1119	30	109.55	332.45
33X	109.60	1057	12	994	12		
33Y	109.65	1057	36	1120	30		
34X		1058	12	995	12	109.70	333.20
34Y		1058	36	1121	30	109.75	333.05
35X	109.80	1059	12	996	12		
35Y	109.85	1059	36	1122	30		
36X		1060	12	997	12	109.90	333.80
36Y		1060	36	1123	30	109.95	333.65
37X	110.00	1061	12	998	12		
37Y	110.05	1061	36	1124	30		
38X		1062	12	999	12	110.10	334.40
38Y		1062	36	1125	30	110.15	334.25
39X	110.20	1063	12	1000	12		
39Y	110.25	1063	36	1126	30		
40X		1064	12	1001	12	110.3	335
40Y		1064	36	1127	30	110.35	334.85
41X	110.40	1065	12	1002	12		
41Y	110.45	1065	36	1128	30		
42X		1066	12	1003	12	110.50	329.60
42Y		1066	36	1129	30	110.55	329.45
43X	110.60	1067	12	1004	12		
43Y	110.65	1067	36	1130	30		
44X		1068	12	1005	12	110.70	330.20

Channel	VOR MHz	DME/TACAN				ILS	
		Airborne		Ground			
		Int. Freq. MHz	Pulse Code <i>usec</i>	Reply Freq. MHz	Pulse Code <i>usec</i>	Localizer MHz	Glide Slope MHz
44Y		1068	36	1131	30	110.75	330.05
45X	110.80	1069	12	1006	12		
45Y	110.85	1069	36	1132	30		
46X		1070	12	1007	12	110.90	330.80
46Y		1070	36	1133	30	110.95	330.65
47X	111.00	1071	12	1008	12		
47Y	111.05	1071	36	1134	30		
48X		1072	12	1009	12	111.10	331.70
48Y		1072	36	1135	30	111.15	331.55
49X	111.20	1073	12	1010	12		
49Y	111.25	1073	36	1136	30		
50X		1074	12	1011	12	111.30	332.30
50Y		1074	36	1137	30	111.35	332.15
51X	111.40	1075	12	1012	12		
51Y	111.45	1075	36	1138	30		
52X		1076	12	1013	12	111.50	332.90
52Y		1076	36	1139	30	111.55	332.75
53X	111.60	1077	12	1014	12		
53Y	111.65	1077	36	1140	30		
54X		1078	12	1015	12	111.70	333.50
54Y		1078	36	1141	30	111.75	333.35
55X	111.80	1079	12	1016	12		
55Y	111.85	1079	36	1142	30		
56X		1080	12	1017	12	111.90	331.10
56Y		1080	36	1143	30	111.95	330.95
57X	112.00	1081	12	1018	12		
57Y	112.05	1081	36	1144	30		
58X	112.10	1082	12	1019	12		
58Y	112.15	1082	36	1145	30		
59X	112.20	1083	12	1020	12		
59Y	112.25	1083	36	1146	30		
60X		1084	12	1021	12		
60Y		1084	36	1147	30		
61X		1085	12	1022	12		
61Y		1085	36	1148	30		
62X		1086	12	1023	12		
62Y		1086	36	1149	30		
63X		1087	12	1024	12		
63Y		1087	36	1150	30		
64X		1088	12	1151	12		
64Y		1088	36	1025	30		
65X		1089	12	1152	12		
65Y		1089	36	1026	30		
66X		1090	12	1153	12		
66Y		1090	36	1027	30		

Channel	VOR MHz	DME/TACAN				ILS	
		Airborne		Ground			
		Int. Freq. MHz	Pulse Code <i>usec</i>	Reply Freq. MHz	Pulse Code <i>usec</i>	Localizer MHz	Glide Slope MHz
67X		1091	12	1154	12		
67Y		1091	36	1028	30		
68X		1092	12	1155	12		
68Y		1092	36	1029	30		
69X		1093	12	1156	12		
69Y		1093	36	1030	30		
70X	112.30	1094	12	1157	12		
70Y	112.35	1094	36	1031	30		
71X	112.40	1095	12	1158	12		
71Y	112.45	1095	36	1032	30		
72X	112.50	1096	12	1159	12		
72Y	112.55	1096	36	1033	30		
73X	112.60	1097	12	1160	12		
73Y	112.65	1097	36	1034	30		
74X	112.70	1098	12	1161	12		
74Y	112.75	1098	36	1035	30		
75X	112.80	1099	12	1162	12		
75Y	112.85	1099	36	1036	30		
76X	112.90	1100	12	1163	12		
76Y	112.95	1100	36	1037	30		
77X	113.00	1101	12	1164	12		
77Y	113.05	1101	36	1038	30		
78X	113.10	1102	12	1165	12		
78Y	113.15	1102	36	1039	30		
79X	113.20	1103	12	1166	12		
79Y	113.25	1103	36	1040	30		
80X	113.30	1104	12	1167	12		
80Y	113.35	1104	36	1041	30		
81X	113.40	1105	12	1168	12		
81Y	113.45	1105	36	1042	30		
82X	113.50	1106	12	1169	12		
82Y	113.55	1106	36	1043	30		
83X	113.60	1107	12	1170	12		
83Y	113.65	1107	36	1044	30		
84X	113.70	1108	12	1171	12		
84Y	113.75	1108	36	1045	30		
85X	113.80	1109	12	1172	12		
85Y	113.85	1109	36	1046	30		
86X	113.90	1110	12	1173	12		
86Y	113.95	1110	36	1047	30		
87X	114.00	1111	12	1174	12		
87Y	114.05	1111	36	1048	30		
88X	114.10	1112	12	1175	12		
88Y	114.15	1112	36	1049	30		
89X	114.20	1113	12	1176	12		

Channel	VOR MHz	DME/TACAN				ILS	
		Airborne		Ground			
		Int. Freq. MHz	Pulse Code <i>usec</i>	Reply Freq. MHz	Pulse Code <i>usec</i>	Localizer MHz	Glide Slope MHz
89Y	114.25	1113	36	1050	30		
90X	114.30	1114	12	1177	12		
90Y	114.35	1114	36	1051	30		
91X	114.40	1115	12	1178	12		
91Y	114.45	1115	36	1052	30		
92X	114.50	1116	12	1179	12		
92Y	114.55	1116	36	1053	30		
93X	114.60	1117	12	1180	12		
93Y	114.65	1117	36	1054	30		
94X	114.70	1118	12	1181	12		
94Y	114.75	1118	36	1055	30		
95X	114.80	1119	12	1182	12		
95Y	114.85	1119	36	1056	30		
96X	114.90	1120	12	1183	12		
96Y	114.95	1120	36	1057	30		
97X	115.00	1121	12	1184	12		
97Y	115.05	1121	36	1058	30		
98X	115.10	1122	12	1185	12		
98Y	115.15	1122	36	1059	30		
99X	115.20	1123	12	1186	12		
99Y	115.25	1123	36	1060	30		
100X	115.30	1124	12	1187	12		
100Y	115.35	1124	36	1061	30		
101X	115.40	1125	12	1188	12		
101Y	115.45	1125	36	1062	30		
102X	115.50	1126	12	1189	12		
102Y	115.55	1126	36	1063	30		
103X	115.60	1127	12	1190	12		
103Y	115.65	1127	36	1064	30		
104X	115.70	1128	12	1191	12		
104Y	115.75	1128	36	1065	30		
105X	115.80	1129	12	1192	12		
105Y	115.85	1129	36	1066	30		
106X	115.90	1130	12	1193	12		
106Y	115.95	1130	36	1067	30		
107X	116.00	1131	12	1194	12		
107Y	116.05	1131	36	1068	30		
108X	116.1	1132	12	1195	12		
108Y	116.15	1132	36	1069	30		
109X	116.20	1133	12	1196	12		
109Y	116.25	1133	36	1070	30		
110X	116.30	1134	12	1197	12		
110Y	116.35	1134	36	1071	30		
111X	116.40	1135	12	1198	12		
111Y	116.45	1135	36	1072	30		



Channel	VOR MHz	DME/TACAN				ILS	
		Airborne		Ground			
		Int. Freq. MHz	Pulse Code <i>usec</i>	Reply Freq. MHz	Pulse Code <i>usec</i>	Localizer MHz	Glide Slope MHz
112X	116.5	1136	12	1199	12		
112Y	116.55	1136	36	1073	30		
113X	116.6	1137	12	1200	12		
113Y	116.65	1137	36	1074	30		
114X	116.70	1138	12	1201	12		
114Y	116.75	1138	36	1075	30		
115X	116.80	1139	12	1202	12		
115Y	116.85	1139	36	1076	30		
116X	116.90	1140	12	1203	12		
116Y	116.95	1140	36	1077	30		
117X	117.00	1141	12	1204	12		
117Y	117.05	1141	36	1078	30		
118X	117.10	1142	12	1205	12		
118Y	117.15	1142	36	1079	30		
119X	117.20	1143	12	1206	12		
119Y	117.25	1143	36	1080	30		
120X	117.30	1144	12	1207	12		
120Y	117.35	1144	36	1081	30		
121X	117.40	1145	12	1208	12		
121Y	117.45	1145	36	1082	30		
122X	117.50	1146	12	1209	12		
122Y	117.55	1146	36	1083	30		
123X	117.60	1147	12	1210	12		
123Y	117.65	1147	36	1084	30		
124X	117.70	1148	12	1211	12		
124Y	117.75	1148	36	1085	30		
125X	117.80	1149	12	1212	12		
125Y	117.85	1149	36	1086	30		
126X	117.90	1150	12	1213	12		
126Y	117.95	1150	36	1087	30		

#### 4.3.6 Channeling Plan for Assignments in the Band 29.89-50 MHz

This plan is a guide for identifying the center frequencies normally used for assignments with necessary bandwidths equal to or less than 16 kHz.

#### CONDITIONS AND LIMITATIONS

1. Narrowband Operations. Assignments with necessary bandwidths equal to or less than 16 kHz (narrowband assignments) may be authorized on the center frequencies shown in this plan and on qualified interstitial channels. A “qualified interstitial channel” is one which:

- Has a center frequency which falls exactly halfway between two adjacent center frequencies shown in this plan,
- Does not overlap an all-government-agencies (AGA) channel,
- Will result in more efficient use of the spectrum, and

- d. Has been properly coordinated with all affected agencies.
- 2. Wideband Operations. Assignments with necessary bandwidths greater than 16 kHz (wideband assignments) may also be authorized in this band, provided such assignments:
  - a. Do not exceed 40 kHz of necessary bandwidth,
  - b. Do not overlap an all-government-agencies (AGA) channel,
  - c. Are positioned between the center frequencies shown in this plan when this will result in more efficient use of the spectrum,
  - d. Have been properly coordinated with all affected agencies, and
  - e. Are needed to satisfy requirements which cannot be accommodated with narrowband state-of-the-art equipment, or
  - f. Are in direct support of military tactical and training operations which conform to the conditions and limitations of Section 7.15.4.
- 3. Use of Coded Squelch. Coded squelch (squelch control techniques) will be used whenever this technique will promote more efficient use of the spectrum; (e.g. use of fewer frequencies, sharing of frequencies, reduction or elimination of interference, etc.)

### EXCEPTIONS

Exceptions to the above conditions and limitations will be considered by the FAS on a case-by-case basis.

29.9								
30.01	32.01	34.01	36.01		40.01	41.01		
30.03	32.03	34.03	36.03		40.03	41.03		
30.05	32.05	34.05	36.05		40.05	41.05		
30.07	32.07	34.07	36.07		40.07	41.07		
30.09	32.09	34.09	36.09		40.09	41.09		
30.11	32.11	34.11	36.11		40.11	41.11		
30.13	32.13	34.13	36.13		40.13	41.13		
30.15	32.15	34.15	36.15		40.15	41.15		
30.17	32.17	34.17	36.17		40.17	41.17		
30.19	32.19	34.19	36.19		40.19	41.19		
30.21	32.21	34.21	36.21		40.21	41.21		
30.23	32.23	34.23	36.23		40.23	41.23		
30.25	32.25	34.25	36.25		40.25	41.25		
30.27	32.27	34.27	36.27	38.27	40.27	41.27		
30.29	32.29	34.29	36.29	38.29	40.29	41.29		
30.31	32.31	34.31	36.31	38.31	40.31	41.31		
30.33	32.33	34.33	36.33	38.33	40.33	41.33		
30.35	32.35	34.35	36.35	38.35	40.35	41.35		
30.37	32.37	34.37	36.37	38.37	40.37	41.37		
30.39	32.39	34.39	36.39	38.39	40.39	41.39		
30.41	32.41	34.41	36.41	38.41	40.41	41.41		
30.43	32.43	34.43	36.43	38.43	40.43	41.43		
30.45	32.45	34.45	36.45	38.45	40.45	41.45		
30.47	32.47	34.47	36.47	38.47	40.47	41.47		
30.49	32.49	34.49	36.49	38.49	40.49	41.49		
30.51	32.51	34.51	36.51	38.51	40.51	41.51		
30.53	32.53	34.53	36.53	38.53	40.53	41.53		
30.55	32.55	34.55	36.55	38.55	40.55	41.55		
	32.57	34.57	36.57	38.57	40.57	41.57		
	32.59	34.59	36.59	38.59	40.59	41.59		
	32.61	34.61	36.61	38.61	40.61	41.61	46.61	49.61
	32.63	34.63	36.63	38.63	40.63	41.63	46.63	49.63
	32.65	34.65	36.65	38.65	40.65	41.65	46.65	49.65

32.67	34.67	36.67	38.67	40.67	41.67	46.67	49.67
32.69	34.69	36.69	38.69	40.69	41.69	46.69	49.69
32.71	34.71	36.71	38.71	40.71	41.71	46.71	49.71
32.73	34.73	36.73	38.73	40.73	41.73	46.73	49.73
32.75	34.75	36.75	38.75	40.75	41.75	46.75	49.75
32.77	34.77	36.77	38.77	40.77	41.77	46.77	49.77
32.79	34.79	36.79	38.79	40.79	41.79	46.79	49.79
32.81	34.81	36.81	38.81	40.81	41.81	46.81	49.81
32.83	34.83	36.83	38.83	40.83	41.83	46.83	49.83
32.85	34.85	36.85	38.85	40.85	41.85	46.85	49.85
32.87	34.87	36.87	38.87	40.87	41.87	46.87	49.87
32.89	34.89	36.89	38.89	40.89	41.89	46.89	49.89
32.91	34.91	36.91	38.91	40.91	41.91	46.91	49.91
32.93	34.93	36.93	38.93	40.93	41.93	46.93	49.93
32.95	34.95	36.95	38.95	40.95	41.95	46.95	49.95
32.97	34.97	36.97	38.97	40.97	41.97	46.97	49.97
32.99	34.99	36.99	38.99	40.99	41.99	46.99	49.99

#### 4.3.7 Channeling Plan for Assignments in the Band 162-174 MHz

This channeling plan is a guide for identifying the center frequencies for assignments used with necessary bandwidths of 6.25 kHz or 12.5 kHz. The channeling plan contains two tables, Table 1 contains center frequencies for channel pairs and Table 2 contains center frequencies for single frequency operations. This plan also includes conditions and limitations for use of assignments in the band 162-174 MHz. The addition of the 6.25 kHz channel spacing supports agencies purchasing equipment capable of using this bandwidth. There is no requirement for agencies to transition to 6.25 kHz channels.

##### CONDITIONS AND LIMITATIONS

1. Narrowband Operations. Narrowband assignments (with a necessary bandwidth of less than 12.5 kHz) may be authorized on the center frequencies identified in this plan.

2. Wideband Operations. Wideband assignments (with necessary bandwidths equal to or greater than 12.5 kHz) for new systems are not authorized. Renewals for wideband assignments may be granted with the understanding that operations are subject to the provisions set forth in paragraph 2a below and Section 5.3.5 of this Manual. As an exception, NOAA Weather Radio operations on channels in the frequency range 162.359375-162.590625 MHz may continue to operate with necessary bandwidths equal to 16 kHz. The Automatic Identification System (AIS) (162.025 MHz) will also continue to operate with a 25 kHz bandwidth pursuant to the International Telecommunication Union (ITU) and International Maritime Organization (IMO). The ground-to-ground portion of the FAA Remote Radio Control System (RRCS) will operate as an on-demand, non-continuous, one-way transmitter with a necessary bandwidth up to 14.5 kHz using 165.7625 MHz, unless restricted by Canadian coordination.

Wideband operations may continue after December 31, 2006 with the understanding that an agency with wideband operations ultimately bears responsibility to mitigate harmful interference (e.g. change to narrowband operations, alter technical operating characteristics, change frequency, or assist the narrowband user to find another frequency) within 180<sup>1</sup> days of notification of an adjacent narrowband use requirement. Agencies requiring use of frequencies for narrowband operations, where wideband operations overlap the proposed narrowband operations shall submit a frequency proposal as formal notice through the FAS assignment process after concluding that they do not have other available options. Prior to formal

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<sup>1</sup> For the purpose of this paragraph 180 days begins when the frequency proposal for the specific narrowband frequency first appears on an NTIA FAS Agenda.

notification the agency requesting narrowband operations shall inform the agency(ies) with wideband operations of the intended use of the adjacent narrowband frequency (Section 8.2.2). If at any time prior to or within 60 days of formal notification, either agency concludes that they cannot identify between them a resolution, the agency with wideband operations shall submit documentation to the FAS substantiating the requirement for continued wideband operations and describing the options considered in their discussions with the narrowband user. Agencies with wideband operations who do not submit substantiating documentation to the FAS shall be considered in concurrence with the proposed narrowband operation. The FAS will evaluate the documentation and identify any options not previously considered or possibly not available to the two agencies involved. If the subcommittee cannot identify a solution that can be agreed by the two parties, the issue will be referred in accordance with Section 8.1.1 paragraph 4. In cases where no solution can be found, the wideband operations may continue on a non-interference basis.

3. Use of Coded Squelch. Coded squelch (squelch control techniques) will be used whenever this technique will promote more efficient use of the spectrum; e.g. use of fewer frequencies, sharing of frequencies, reduction or elimination of interference, etc.

4. Time Division Multiple Access (TDMA) Operations. TDMA systems, with at least 1 voice channel per 12.5 kHz, will be allowed and can be accommodated on adjacent 12.5 kHz channels listed in this channeling plan. The center frequency of the TDMA channel must be offset midway between the existing narrowband channels to avoid adjacent channel interference problems with existing or planned narrowband systems. Refer to Section 5.3.5 for technical standards.

5. Paired Frequency Operations. The channeling plan identifies 280 (12.5 kHz) and 560 (6.25 kHz) pairs of frequencies that are intended to be used for two-frequency simplex operations using equipment operating with a necessary bandwidth less than 12.5 kHz. The paired-use portion includes 359 (12.5 kHz) and 718 (6.25 kHz) channels, however 79 (12.5 kHz) and 158 (6.25 kHz) of these channels cannot be used for paired use due to existing limitations on the use of one of the frequencies that comprise these pairs (i.e., the 19 frequencies allotted for the NOAA weather radios, the 17 frequencies contained within the non-federal sub-band 173.2-173.4 MHz, and 43 (12.5 kHz) and 86 (6.25 kHz) frequencies designated for other specified use by US footnote).

a. For paired frequency operations, the frequencies in the range 162.0500-166.4875 MHz (12.5 kHz) and 162.009375-166.490625 MHz (6.25 kHz) will be used for land station receive (or mobile transmit), and frequencies in the range 169.5125-173.9875 MHz (12.5 kHz) and 169.509375-173.990625 MHz (6.25 kHz) will be used for land station transmissions (or mobile receive).

b. Base stations with a power not greater than 125 watts are permitted to transmit in the range 162.0500-166.4875 MHz (12.5 kHz) and 162.009375-166.490625 MHz (6.25 kHz) for access to the repeater.

c. Mobile and base stations are permitted to use repeater transmit frequencies for talk-around communications.

d. Unpaired single frequency operations may be authorized using either of the paired frequencies, except pairs allotted AGA, if the requesting agency believes it to be a more effective use of the spectrum. All such assignments must bear the Record Note S396 (see Annex A). However, as long as an agency has assignments for unpaired single frequency operations on frequencies designated for paired operations, that agency shall not be authorized paired frequency assignments on designated paired frequencies allotted AGA, unless justified otherwise.

e. An agency may use any of their allotted frequencies in the range 162.0500-166.4875 MHz (12.5 kHz) and 162.009375-166.490625 MHz (6.25 kHz) and any of their allotted frequencies in the range 169.5125-173.9875 MHz (12.5 kHz) and 169.509375-173.990625 MHz (6.25 kHz) to make up a single channel pair.

f. An agency may use any of their allotted frequencies in the range 166.5-169.5 MHz (12.5 kHz) and 166.496875-169.503125 MHz (6.25 kHz) and any of their allotted frequencies in the ranges 162.0500-166.4875 MHz (12.5 kHz) and 162.009375-166.490625 MHz (6.25 kHz) and 169.5125-173.9875 MHz (12.5 kHz) and 169.509375-173.990625 MHz (6.25 kHz) to make up a single channel pair if the requesting agency believes it to be more effective use of the spectrum and if it complies, in part, to the provisions of

paragraph 5.a.

6. Single Frequency Operations. The channeling plan identifies 382 (12.5 kHz) and 764 (6.25 kHz) center frequencies that are intended to be used for single frequency operations with necessary bandwidths less than 12.5 kHz. The number of frequencies available for single frequency operations includes the 241 (12.5 kHz) and 484 (6.25 kHz) center frequencies contained in the frequency range 166.5-169.5 MHz (12.5 kHz) and 166.496875-169.503125 MHz (6.25 kHz) plus those that cannot be used for paired operations in the remainder of the band.

Unpaired single frequency operations may be authorized using either of the paired frequency sub-bands (162.009375-166.490625 MHz and 169.509375-173.990625 MHz), except pairs allotted AGA, if the requesting agency believes it to be more effective use of the spectrum. All such assignments must bear the Record Note S396 (see Annex A). However, as long as an agency has assignments for unpaired single frequency operations on frequencies listed in Table 1, that agency shall not be authorized paired frequency assignments on those frequencies in Table 1 allotted AGA, unless justified.

7. Grandfathered Operations. Existing assignments that did not conform to (1) the provisions of paragraphs 2, 5 and 6 and (2) assignments that were converted or are converting to comply with the narrowband mandate are grandfathered until a replacement to those systems are necessary. Those assignments shall bear Record Note S391. Additionally, expansion of existing systems will continue to be authorized on the system's current operating frequencies.

8. Use of the Band by Military Agencies. Use of the band 162-174 MHz by the military agencies is limited to non-tactical or intra-base radio operations with the following provisions:

a. Frequency assignments may be authorized on the center frequencies designated AF/AR.

b. Frequency assignments for certified trunked systems may be authorized on the center frequencies allotted primarily for non-military agencies or AGA, subject to the conditions imposed on the NTIA certification of spectrum support and coordination between the affected agencies. The priority note P074 shall be applied to assignments on center frequencies allotted primarily for non-military agencies and those allotted for shared use, unless the agency(ies) to which the frequency is primarily allotted agrees to waive this requirement. Applicant agencies obtaining waivers to the imposition of P074 on any assignment shall include in the assignment application the coordination note C095 (see Section 9.8.2, paragraph 18, and Annex A). If a waiver agreement contains any special arrangements, the terms or text of the arrangements must be submitted to the FAS Secretary, where an FAS administrative document number will be assigned. Reference to these arrangements (using the FAS administrative document number as a reference) also shall be included in the frequency assignment application as an \*M002 note entry in the Circuit Remarks (see Section 9.8.2, paragraph 39k, Annex A).

c. Frequency assignments for purposes other than trunked systems may be authorized on the center frequencies allotted primarily for non-military agencies or AGA, provided the proper selection and coordination procedures have been followed, and provided the priority note P074 is applied to each such assignment.

9. Exceptions to the above conditions, limitations, and frequency selection/coordination procedures will be considered by the FAS on a case-by-case basis.

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
162.0125	162.009375
	162.015625
162.0250	162.021875
	162.028125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
162.0375	162.034375
	162.040625
162.0500	162.046875
	162.053125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
162.0625	162.059375
	162.065625
162.0750	162.071875
	162.078125
162.0875	162.084375
	162.090625
162.1000	162.096875
	162.103125
162.1125	162.109375
	162.115625
162.1250	162.121875
	162.128125
162.1375	162.134375
	162.140625
162.1500	162.146875
	162.153125
162.1625	162.159375
	162.165625
162.1750	162.171875
	162.178125
162.1875	162.184375
	162.190625
162.2000	162.196875
	162.203125
162.2125	162.209375
	162.215625
162.2250	162.221875
	162.228125
162.2375	162.234375
	162.240625
162.2500	162.246875
	162.253125
162.2625	162.259375
	162.265625
162.2750	162.271875
	162.278125
162.2875	162.284375
	162.290625
162.3000	162.296875
	162.303125
162.3125	162.309375
	162.315625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
162.3250	162.321875
	162.328125
162.3375	162.334375
	162.340625
162.3500	162.346875
	162.353125
162.3625	162.359375
	162.365625
162.3750	162.371875
	162.378125
162.3875	162.384375
	162.390625
162.4000	162.396875
	162.403125
162.4125	162.409375
	162.415625
162.4250	162.421875
	162.428125
162.4375	162.434375
	162.440625
162.4500	162.446875
	162.453125
162.4625	162.459375
	162.465625
162.4750	162.471875
	162.478125
162.4875	162.484375
	162.490625
162.5000	162.496875
	162.503125
162.5125	162.509375
	162.515625
162.5250	162.521875
	162.528125
162.5375	162.534375
	162.540625
162.5500	162.546875
	162.553125
162.5625	162.559375
	162.565625
162.5750	162.571875
	162.578125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
162.5875	162.584375
	162.590625
162.6000	162.596875
	162.603125
162.6125	162.609375
	162.615625
162.6250	162.621875
	162.628125
162.6375	162.634375
	162.640625
162.6500	162.646875
	162.653125
162.6625	162.659375
	162.665625
162.6750	162.671875
	162.678125
162.6875	162.684375
	162.690625
162.7000	162.696875
	162.703125
162.7125	162.709375
	162.715625
162.7250	162.721875
	162.728125
162.7375	162.734375
	162.740625
162.7500	162.746875
	162.753125
162.7625	162.759375
	162.765625
162.7750	162.771875
	162.778125
162.7875	162.784375
	162.790625
162.8000	162.796875
	162.803125
162.8125	162.809375
	162.815625
162.8250	162.821875
	162.828125
162.8375	162.834375
	162.840625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
162.8500	162.846875
	162.853125
162.8625	162.859375
	162.865625
162.8750	162.871875
	162.878125
162.8875	162.884375
	162.890625
162.9000	162.896875
	162.903125
162.9125	162.909375
	162.915625
162.9250	162.921875
	162.928125
162.9375	162.934375
	162.940625
162.9500	162.946875
	162.953125
162.9625	162.959375
	162.965625
162.9750	162.971875
	162.978125
162.9875	162.984375
	162.990625
163.0000	162.996875
	163.003125
163.0125	163.009375
	163.015625
163.0250	163.021875
	163.028125
163.0375	163.034375
	163.040625
163.0500	163.046875
	163.053125
163.0625	163.059375
	163.065625
163.0750	163.071875
	163.078125
163.0875	163.084375
	163.090625
163.1000	163.096875
	163.103125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
163.1125	163.109375
	163.115625
163.1250	163.121875
	163.128125
163.1375	163.134375
	163.140625
163.1500	163.146875
	163.153125
163.1625	163.159375
	163.165625
163.1750	163.171875
	163.178125
163.1875	163.184375
	163.190625
163.2000	163.196875
	163.203125
163.2125	163.209375
	163.215625
163.2250	163.221875
	163.228125
163.2375	163.234375
	163.240625
163.2500	163.246875
	163.253125
163.2625	163.259375
	163.265625
163.2750	163.271875
	163.278125
163.2875	163.284375
	163.290625
163.3000	163.296875
	163.303125
163.3125	163.309375
	163.315625
163.3250	163.321875
	163.328125
163.3375	163.334375
	163.340625
163.3500	163.346875
	163.353125
163.3625	163.359375
	163.365625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
163.3750	163.371875
	163.378125
163.3875	163.384375
	163.390625
163.4000	163.396875
	163.403125
163.4125	163.409375
	163.415625
163.4250	163.421875
	163.428125
163.4375	163.434375
	163.440625
163.4500	163.446875
	163.453125
163.4625	163.459375
	163.465625
163.4750	163.471875
	163.478125
163.4875	163.484375
	163.490625
163.5000	163.496875
	163.503125
163.5125	163.509375
	163.515625
163.5250	163.521875
	163.528125
163.5375	163.534375
	163.540625
163.5500	163.546875
	163.553125
163.5625	163.559375
	163.565625
163.5750	163.571875
	163.578125
163.5875	163.584375
	163.590625
163.6000	163.596875
	163.603125
163.6125	163.609375
	163.615625
163.6250	163.621875
	163.628125



TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
163.6375	163.634375
	163.640625
163.6500	163.646875
	163.653125
163.6625	163.659375
	163.665625
163.6750	163.671875
	163.678125
163.6875	163.684375
	163.690625
163.7000	163.696875
	163.703125
163.7125	163.709375
	163.715625
163.7250	163.721875
	163.728125
163.7375	163.734375
	163.740625
163.7500	163.746875
	163.753125
163.7625	163.759375
	163.765625
163.7750	163.771875
	163.778125
163.7875	163.784375
	163.790625
163.8000	163.796875
	163.803125
163.8125	163.809375
	163.815625
163.8250	163.821875
	163.828125
163.8375	163.834375
	163.840625
163.8500	163.846875
	163.853125
163.8625	163.859375
	163.865625
163.8750	163.871875
	163.878125
163.8875	163.884375
	163.890625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
163.9000	163.896875
	163.903125
163.9125	163.909375
	163.915625
163.9250	163.921875
	163.928125
163.9375	163.934375
	163.940625
163.9500	163.946875
	163.953125
163.9625	163.959375
	163.965625
163.9750	163.971875
	163.978125
163.9875	163.984375
	163.990625
164.0000	163.996875
	164.003125
164.0125	164.009375
	164.015625
164.0250	164.021875
	164.028125
164.0375	164.034375
	164.040625
164.0500	164.046875
	164.053125
164.0625	164.059375
	164.065625
164.0750	164.071875
	164.078125
164.0875	164.084375
	164.090625
164.1000	164.096875
	164.103125
164.1125	164.109375
	164.115625
164.1250	164.121875
	164.128125
164.1375	164.134375
	164.140625
164.1500	164.146875
	164.153125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
164.1625	164.159375
	164.165625
164.1750	164.171875
	164.178125
164.1875	164.184375
	164.190625
164.2000	164.196875
	164.203125
164.2125	164.209375
	164.215625
164.2250	164.221875
	164.228125
164.2375	164.234375
	164.240625
164.2500	164.246875
	164.253125
164.2625	164.259375
	164.265625
164.2750	164.271875
	164.278125
164.2875	164.284375
	164.290625
164.3000	164.296875
	164.303125
164.3125	164.309375
	164.315625
164.3250	164.321875
	164.328125
164.3375	164.334375
	164.340625
164.3500	164.346875
	164.353125
164.3625	164.359375
	164.365625
164.3750	164.371875
	164.378125
164.3875	164.384375
	164.390625
164.4000	164.396875
	164.403125
164.4125	164.409375
	164.415625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
164.4250	164.421875
	164.428125
164.4375	164.434375
	164.440625
164.4500	164.446875
	164.453125
164.4625	164.459375
	164.465625
164.4750	164.471875
	164.478125
164.4875	164.484375
	164.490625
164.5000	164.496875
	164.503125
164.5125	164.509375
	164.515625
164.5250	164.521875
	164.528125
164.5375	164.534375
	164.540625
164.5500	164.546875
	164.553125
164.5625	164.559375
	164.565625
164.5750	164.571875
	164.578125
164.5875	164.584375
	164.590625
164.6000	164.596875
	164.603125
164.6125	164.609375
	164.615625
164.6250	164.621875
	164.628125
164.6375	164.634375
	164.640625
164.6500	164.646875
	164.653125
164.6625	164.659375
	164.665625
164.6750	164.671875
	164.678125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
164.6875	164.684375
	164.690625
164.7000	164.696875
	164.703125
164.7125	164.709375
	164.715625
164.7250	164.721875
	164.728125
164.7375	164.734375
	164.740625
164.7500	164.746875
	164.753125
164.7625	164.759375
	164.765625
164.7750	164.771875
	164.778125
164.7875	164.784375
	164.790625
164.8000	164.796875
	164.803125
164.8125	164.809375
	164.815625
164.8250	164.821875
	164.828125
164.8375	164.834375
	164.840625
164.8500	164.846875
	164.853125
164.8625	164.859375
	164.865625
164.8750	164.871875
	164.878125
164.8875	164.884375
	164.890625
164.9000	164.896875
	164.903125
164.9125	164.909375
	164.915625
164.9250	164.921875
	164.928125
164.9375	164.934375
	164.940625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
164.9500	164.946875
	164.953125
164.9625	164.959375
	164.965625
164.9750	164.971875
	164.978125
164.9875	164.984375
	164.990625
165.0000	164.996875
	165.003125
165.0125	165.009375
	165.015625
165.0250	165.021875
	165.028125
165.0375	165.034375
	165.040625
165.0500	165.046875
	165.053125
165.0625	165.059375
	165.065625
165.0750	165.071875
	165.078125
165.0875	165.084375
	165.090625
165.1000	165.096875
	165.103125
165.1125	165.109375
	165.115625
165.1250	165.121875
	165.128125
165.1375	165.134375
	165.140625
165.1500	165.146875
	165.153125
165.1625	165.159375
	165.165625
165.1750	165.171875
	165.178125
165.1875	165.184375
	165.190625
165.2000	165.196875
	165.203125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
165.2125	165.209375
	165.215625
165.2250	165.221875
	165.228125
165.2375	165.234375
	165.240625
165.2500	165.246875
	165.253125
165.2625	165.259375
	165.265625
165.2750	165.271875
	165.278125
165.2875	165.284375
	165.290625
165.3000	165.296875
	165.303125
165.3125	165.309375
	165.315625
165.3250	165.321875
	165.328125
165.3375	165.334375
	165.340625
165.3500	165.346875
	165.353125
165.3625	165.359375
	165.365625
165.3750	165.371875
	165.378125
165.3875	165.384375
	165.390625
165.4000	165.396875
	165.403125
165.4125	165.409375
	165.415625
165.4250	165.421875
	165.428125
165.4375	165.434375
	165.440625
165.4500	165.446875
	165.453125
165.4625	165.459375
	165.465625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
165.4750	165.471875
	165.478125
165.4875	165.484375
	165.490625
165.5000	165.496875
	165.503125
165.5125	165.509375
	165.515625
165.5250	165.521875
	165.528125
165.5375	165.534375
	165.540625
165.5500	165.546875
	165.553125
165.5625	165.559375
	165.565625
165.5750	165.571875
	165.578125
165.5875	165.584375
	165.590625
165.6000	165.596875
	165.603125
165.6125	165.609375
	165.615625
165.6250	165.621875
	165.628125
165.6375	165.634375
	165.640625
165.6500	165.646875
	165.653125
165.6625	165.659375
	165.665625
165.6750	165.671875
	165.678125
165.6875	165.684375
	165.690625
165.7000	165.696875
	165.703125
165.7125	165.709375
	165.715625
165.7250	165.721875
	165.728125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
165.7375	165.734375
	165.740625
165.7500	165.746875
	165.753125
165.7625	165.759375
	165.765625
165.7750	165.771875
	165.778125
165.7875	165.784375
	165.790625
165.8000	165.796875
	165.803125
165.8125	165.809375
	165.815625
165.8250	165.821875
	165.828125
165.8375	165.834375
	165.840625
165.8500	165.846875
	165.853125
165.8625	165.859375
	165.865625
165.8750	165.871875
	165.878125
165.8875	165.884375
	165.890625
165.9000	165.896875
	165.903125
165.9125	165.909375
	165.915625
165.9250	165.921875
	165.928125
165.9375	165.934375
	165.940625
165.9500	165.946875
	165.953125
165.9625	165.959375
	165.965625
165.9750	165.971875
	165.978125
165.9875	165.984375
	165.990625

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
166.0000	165.996875
	166.003125
166.0125	166.009375
	166.015625
166.0250	166.021875
	166.028125
166.0375	166.034375
	166.040625
166.0500	166.046875
	166.053125
166.0625	166.059375
	166.065625
166.0750	166.071875
	166.078125
166.0875	166.084375
	166.090625
166.1000	166.096875
	166.103125
166.1125	166.109375
	166.115625
166.1250	166.121875
	166.128125
166.1375	166.134375
	166.140625
166.1500	166.146875
	166.153125
166.1625	166.159375
	166.165625
166.1750	166.171875
	166.178125
166.1875	166.184375
	166.190625
166.2000	166.196875
	166.203125
166.2125	166.209375
	166.215625
166.2250	166.221875
	166.228125
166.2375	166.234375
	166.240625
166.2500	166.246875
	166.253125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
166.2625	166.259375
	166.265625
166.2750	166.271875
	166.278125
166.2875	166.284375
	166.290625
166.3000	166.296875
	166.303125
166.3125	166.309375
	166.315625
166.3250	166.321875
	166.328125
166.3375	166.334375
	166.340625
166.3500	166.346875
	166.353125
166.3625	166.359375
	166.365625
166.3750	166.371875
	166.378125

TABLE 1: Paired Operations Mobile Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
166.3875	166.384375
	166.390625
166.4000	166.396875
	166.403125
166.4125	166.409375
	166.415625
166.4250	166.421875
	166.428125
166.4375	166.434375
	166.440625
166.4500	166.446875
	166.453125
166.4625	166.459375
	166.465625
166.4750	166.471875
	166.478125
166.4875	166.484375
	166.490625

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
169.5125	169.509375
	169.515625
169.5250	169.521875
	169.528125
169.5375	169.534375
	169.540625
169.5500	169.546875
	169.553125
169.5625	169.559375
	169.565625
169.5750	169.571875
	169.578125
169.5875	169.584375
	169.590625
169.6000	169.596875
	169.603125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
169.6125	169.609375
	169.615625
169.6250	169.621875
	169.628125
169.6375	169.634375
	169.640625
169.6500	169.646875
	169.653125
169.6625	169.659375
	169.665625
169.6750	169.671875
	169.678125
169.6875	169.684375
	169.690625
169.7000	169.696875
	169.703125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
169.7125	169.709375
	169.715625
169.7250	169.721875
	169.728125
169.7375	169.734375
	169.740625
169.7500	169.746875
	169.753125
169.7625	169.759375
	169.765625
169.7750	169.771875
	169.778125
169.7875	169.784375
	169.790625
169.8000	169.796875
	169.803125
169.8125	169.809375
	169.815625
169.8250	169.821875
	169.828125
169.8375	169.834375
	169.840625
169.8500	169.846875
	169.853125
169.8625	169.859375
	169.865625
169.8750	169.871875
	169.878125
169.8875	169.884375
	169.890625
169.9000	169.896875
	169.903125
169.9125	169.909375
	169.915625
169.9250	169.921875
	169.928125
169.9375	169.934375
	169.940625
169.9500	169.946875
	169.953125
169.9625	169.959375
	169.965625
169.9750	169.971875
	169.978125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
169.9875	169.984375
	169.990625
170.0000	169.996875
	170.003125
170.0125	170.009375
	170.015625
170.0250	170.021875
	170.028125
170.0375	170.034375
	170.040625
170.0500	170.046875
	170.053125
170.0625	170.059375
	170.065625
170.0750	170.071875
	170.078125
170.0875	170.084375
	170.090625
170.1000	170.096875
	170.103125
170.1125	170.109375
	170.115625
170.1250	170.121875
	170.128125
170.1375	170.134375
	170.140625
170.1500	170.146875
	170.153125
170.1625	170.159375
	170.165625
170.1750	170.171875
	170.178125
170.1875	170.184375
	170.190625
170.2000	170.196875
	170.203125
170.2125	170.209375
	170.215625
170.2250	170.221875
	170.228125
170.2375	170.234375
	170.240625
170.2500	170.246875
	170.253125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
170.2625	170.259375
	170.265625
170.2750	170.271875
	170.278125
170.2875	170.284375
	170.290625
170.3000	170.296875
	170.303125
170.3125	170.309375
	170.315625
170.3250	170.321875
	170.328125
170.3375	170.334375
	170.340625
170.3500	170.346875
	170.353125
170.3625	170.359375
	170.365625
170.3750	170.371875
	170.378125
170.3875	170.384375
	170.390625
170.4000	170.396875
	170.403125
170.4125	170.409375
	170.415625
170.4250	170.421875
	170.428125
170.4375	170.434375
	170.440625
170.4500	170.446875
	170.453125
170.4625	170.459375
	170.465625
170.4750	170.471875
	170.478125
170.4875	170.484375
	170.490625
170.5000	170.496875
	170.503125
170.5125	170.509375
	170.515625
170.5250	170.521875
	170.528125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
170.5375	170.534375
	170.540625
170.5500	170.546875
	170.553125
170.5625	170.559375
	170.565625
170.5750	170.571875
	170.578125
170.5875	170.584375
	170.590625
170.6000	170.596875
	170.603125
170.6125	170.609375
	170.615625
170.6250	170.621875
	170.628125
170.6375	170.634375
	170.640625
170.6500	170.646875
	170.653125
170.6625	170.659375
	170.665625
170.6750	170.671875
	170.678125
170.6875	170.684375
	170.690625
170.7000	170.696875
	170.703125
170.7125	170.709375
	170.715625
170.7250	170.721875
	170.728125
170.7375	170.734375
	170.740625
170.7500	170.746875
	170.753125
170.7625	170.759375
	170.765625
170.7750	170.771875
	170.778125
170.7875	170.784375
	170.790625
170.8000	170.796875
	170.803125



TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
170.8125	170.809375
	170.815625
170.8250	170.821875
	170.828125
170.8375	170.834375
	170.840625
170.8500	170.846875
	170.853125
170.8625	170.859375
	170.865625
170.8750	170.871875
	170.878125
170.8875	170.884375
	170.890625
170.9000	170.896875
	170.903125
170.9125	170.909375
	170.915625
170.9250	170.921875
	170.928125
170.9375	170.934375
	170.940625
170.9500	170.946875
	170.953125
170.9625	170.959375
	170.965625
170.9750	170.971875
	170.978125
170.9875	170.984375
	170.990625
171.0000	170.996875
	171.003125
171.0125	171.009375
	171.015625
171.0250	171.021875
	171.028125
171.0375	171.034375
	171.040625
171.0500	171.046875
	171.053125
171.0625	171.059375
	171.065625
171.0750	171.071875
	171.078125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
171.0875	171.084375
	171.090625
171.1000	171.096875
	171.103125
171.1125	171.109375
	171.115625
171.1250	171.121875
	171.128125
171.1375	171.134375
	171.140625
171.1500	171.146875
	171.153125
171.1625	171.159375
	171.165625
171.1750	171.171875
	171.178125
171.1875	171.184375
	171.190625
171.2000	171.196875
	171.203125
171.2125	171.209375
	171.215625
171.2250	171.221875
	171.228125
171.2375	171.234375
	171.240625
171.2500	171.246875
	171.253125
171.2625	171.259375
	171.265625
171.2750	171.271875
	171.278125
171.2875	171.284375
	171.290625
171.3000	171.296875
	171.303125
171.3125	171.309375
	171.315625
171.3250	171.321875
	171.328125
171.3375	171.334375
	171.340625
171.3500	171.346875
	171.353125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
171.3625	171.359375
	171.365625
171.3750	171.371875
	171.378125
171.3875	171.384375
	171.390625
171.4000	171.396875
	171.403125
171.4125	171.409375
	171.415625
171.4250	171.421875
	171.428125
171.4375	171.434375
	171.440625
171.4500	171.446875
	171.453125
171.4625	171.459375
	171.465625
171.4750	171.471875
	171.478125
171.4875	171.484375
	171.490625
171.5000	171.496875
	171.503125
171.5125	171.509375
	171.515625
171.5250	171.521875
	171.528125
171.5375	171.534375
	171.540625
171.5500	171.546875
	171.553125
171.5625	171.559375
	171.565625
171.5750	171.571875
	171.578125
171.5875	171.584375
	171.590625
171.6000	171.596875
	171.603125
171.6125	171.609375
	171.615625
171.6250	171.621875
	171.628125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
171.6375	171.634375
	171.640625
171.6500	171.646875
	171.653125
171.6625	171.659375
	171.665625
171.6750	171.671875
	171.678125
171.6875	171.684375
	171.690625
171.7000	171.696875
	171.703125
171.7125	171.709375
	171.715625
171.7250	171.721875
	171.728125
171.7375	171.734375
	171.740625
171.7500	171.746875
	171.753125
171.7625	171.759375
	171.765625
171.7750	171.771875
	171.778125
171.7875	171.784375
	171.790625
171.8000	171.796875
	171.803125
171.8125	171.809375
	171.815625
171.8250	171.821875
	171.828125
171.8375	171.834375
	171.840625
171.8500	171.846875
	171.853125
171.8625	171.859375
	171.865625
171.8750	171.871875
	171.878125
171.8875	171.884375
	171.890625
171.9000	171.896875
	171.903125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
171.9125	171.909375
	171.915625
171.9250	171.921875
	171.928125
171.9375	171.934375
	171.940625
171.9500	171.946875
	171.953125
171.9625	171.959375
	171.965625
171.9750	171.971875
	171.978125
171.9875	171.984375
	171.990625
172.0000	171.996875
	172.003125
172.0125	172.009375
	172.015625
172.0250	172.021875
	172.028125
172.0375	172.034375
	172.040625
172.0500	172.046875
	172.053125
172.0625	172.059375
	172.065625
172.0750	172.071875
	172.078125
172.0875	172.084375
	172.090625
172.1000	172.096875
	172.103125
172.1125	172.109375
	172.115625
172.1250	172.121875
	172.128125
172.1375	172.134375
	172.140625
172.1500	172.146875
	172.153125
172.1625	172.159375
	172.165625
172.1750	172.171875
	172.178125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
172.1875	172.184375
	172.190625
172.2000	172.196875
	172.203125
172.2125	172.209375
	172.215625
172.2250	172.221875
	172.228125
172.2375	172.234375
	172.240625
172.2500	172.246875
	172.253125
172.2625	172.259375
	172.265625
172.2750	172.271875
	172.278125
172.2875	172.284375
	172.290625
172.3000	172.296875
	172.303125
172.3125	172.309375
	172.315625
172.3250	172.321875
	172.328125
172.3375	172.334375
	172.340625
172.3500	172.346875
	172.353125
172.3625	172.359375
	172.365625
172.3750	172.371875
	172.378125
172.3875	172.384375
	172.390625
172.4000	172.396875
	172.403125
172.4125	172.409375
	172.415625
172.4250	172.421875
	172.428125
172.4375	172.434375
	172.440625
172.4500	172.446875
	172.453125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
172.4625	172.459375
	172.465625
172.4750	172.471875
	172.478125
172.4875	172.484375
	172.490625
172.5000	172.496875
	172.503125
172.5125	172.509375
	172.515625
172.5250	172.521875
	172.528125
172.5375	172.534375
	172.540625
172.5500	172.546875
	172.553125
172.5625	172.559375
	172.565625
172.5750	172.571875
	172.578125
172.5875	172.584375
	172.590625
172.6000	172.596875
	172.603125
172.6125	172.609375
	172.615625
172.6250	172.621875
	172.628125
172.6375	172.634375
	172.640625
172.6500	172.646875
	172.653125
172.6625	172.659375
	172.665625
172.6750	172.671875
	172.678125
172.6875	172.684375
	172.690625
172.7000	172.696875
	172.703125
172.7125	172.709375
	172.715625
172.7250	172.721875
	172.728125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
172.7375	172.734375
	172.740625
172.7500	172.746875
	172.753125
172.7625	172.759375
	172.765625
172.7750	172.771875
	172.778125
172.7875	172.784375
	172.790625
172.8000	172.796875
	172.803125
172.8125	172.809375
	172.815625
172.8250	172.821875
	172.828125
172.8375	172.834375
	172.840625
172.8500	172.846875
	172.853125
172.8625	172.859375
	172.865625
172.8750	172.871875
	172.878125
172.8875	172.884375
	172.890625
172.9000	172.896875
	172.903125
172.9125	172.909375
	172.915625
172.9250	172.921875
	172.928125
172.9375	172.934375
	172.940625
172.9500	172.946875
	172.953125
172.9625	172.959375
	172.965625
172.9750	172.971875
	172.978125
172.9875	172.984375
	172.990625
173.0000	172.996875
	173.003125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
173.0125	173.009375
	173.015625
173.0250	173.021875
	173.028125
173.0375	173.034375
	173.040625
173.0500	173.046875
	173.053125
173.0625	173.059375
	173.065625
173.0750	173.071875
	173.078125
173.0875	173.084375
	173.090625
173.1000	173.096875
	173.103125
173.1125	173.109375
	173.115625
173.1250	173.121875
	173.128125
173.1375	173.134375
	173.140625
173.1500	173.146875
	173.153125
173.1625	173.159375
	173.165625
173.1750	173.171875
	173.178125
173.1875	173.184375
	173.190625
173.2000	173.196875
	173.203125
173.2125	173.209375
	173.215625
173.2250	173.221875
	173.228125
173.2375	173.234375
	173.240625
173.2500	173.246875
	173.253125
173.2625	173.259375
	173.265625
173.2750	173.271875
	173.278125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
173.2875	173.284375
	173.290625
173.3000	173.296875
	173.303125
173.3125	173.309375
	173.315625
173.3250	173.321875
	173.328125
173.3375	173.334375
	173.340625
173.3500	173.346875
	173.353125
173.3625	173.359375
	173.365625
173.3750	173.371875
	173.378125
173.3875	173.384375
	173.390625
173.4000	173.396875
	173.403125
173.4125	173.409375
	173.415625
173.4250	173.421875
	173.428125
173.4375	173.434375
	173.440625
173.4500	173.446875
	173.453125
173.4625	173.459375
	173.465625
173.4750	173.471875
	173.478125
173.4875	173.484375
	173.490625
173.5000	173.496875
	173.503125
173.5125	173.509375
	173.515625
173.5250	173.521875
	173.528125
173.5375	173.534375
	173.540625
173.5500	173.546875
	173.553125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
173.5625	173.559375
	173.565625
173.5750	173.571875
	173.578125
173.5875	173.584375
	173.590625
173.6000	173.596875
	173.603125
173.6125	173.609375
	173.615625
173.6250	173.621875
	173.628125
173.6375	173.634375
	173.640625
173.6500	173.646875
	173.653125
173.6625	173.659375
	173.665625
173.6750	173.671875
	173.678125
173.6875	173.684375
	173.690625
173.7000	173.696875
	173.703125
173.7125	173.709375
	173.715625
173.7250	173.721875
	173.728125
173.7375	173.734375
	173.740625
173.7500	173.746875
	173.753125
173.7625	173.759375
	173.765625
173.7750	173.771875
	173.778125

TABLE 1: Paired Operations Land Station Transmit	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
173.7875	173.784375
	173.790625
173.8000	173.796875
	173.803125
173.8125	173.809375
	173.815625
173.8250	173.821875
	173.828125
173.8375	173.834375
	173.840625
173.8500	173.846875
	173.853125
173.8625	173.859375
	173.865625
173.8750	173.871875
	173.878125
173.8875	173.884375
	173.890625
173.9000	173.896875
	173.903125
173.9125	173.909375
	173.915625
173.9250	173.921875
	173.928125
173.9375	173.934375
	173.940625
173.9500	173.946875
	173.953125
173.9625	173.959375
	173.965625
173.9750	173.971875
	173.978125
173.9875	173.984375
	173.990625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
166.5000	166.496875
	166.503125

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
166.5125	166.509375
	166.515625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
166.5250	166.521875 166.528125
166.5375	166.534375 166.540625
166.5500	166.546875 166.553125
166.5625	166.559375 166.565625
166.5750	166.571875 166.578125
166.5875	166.584375 166.590625
166.6000	166.596875 166.603125
166.6125	166.609375 166.615625
166.6250	166.621875 166.628125
166.6375	166.634375 166.640625
166.6500	166.646875 166.653125
166.6625	166.659375 166.665625
166.6750	166.671875 166.678125
166.6875	166.684375 166.690625
166.7000	166.696875 166.703125
166.7125	166.709375 166.715625
166.7250	166.721875 166.728125
166.7375	166.734375 166.740625
166.7500	166.746875 166.753125
166.7625	166.759375 166.765625
166.7750	166.771875 166.778125
166.7875	166.784375 166.790625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
166.8000	166.796875 166.803125
166.8125	166.809375 166.815625
166.8250	166.821875 166.828125
166.8375	166.834375 166.840625
166.8500	166.846875 166.853125
166.8625	166.859375 166.865625
166.8750	166.871875 166.878125
166.8875	166.884375 166.890625
166.9000	166.896875 166.903125
166.9125	166.909375 166.915625
166.9250	166.921875 166.928125
166.9375	166.934375 166.940625
166.9500	166.946875 166.953125
166.9625	166.959375 166.965625
166.9750	166.971875 166.978125
166.9875	166.984375 166.990625
167.0000	166.996875 167.003125
167.0125	167.009375 167.015625
167.0250	167.021875 167.028125
167.0375	167.034375 167.040625
167.0500	167.046875 167.053125
167.0625	167.059375 167.065625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
167.0750	167.071875 167.078125
167.0875	167.084375 167.090625
167.1000	167.096875 167.103125
167.1125	167.109375 167.115625
167.1250	167.121875 167.128125
167.1375	167.134375 167.140625
167.1500	167.146875 167.153125
167.1625	167.159375 167.165625
167.1750	167.171875 167.178125
167.1875	167.184375 167.190625
167.2000	167.196875 167.203125
167.2125	167.209375 167.215625
167.2250	167.221875 167.228125
167.2375	167.234375 167.240625
167.2500	167.246875 167.253125
167.2625	167.259375 167.265625
167.2750	167.271875 167.278125
167.2875	167.284375 167.290625
167.3000	167.296875 167.303125
167.3125	167.309375 167.315625
167.3250	167.321875 167.328125
167.3375	167.334375 167.340625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
167.3500	167.346875 167.353125
167.3625	167.359375 167.365625
167.3750	167.371875 167.378125
167.3875	167.384375 167.390625
167.4000	167.396875 167.403125
167.4125	167.409375 167.415625
167.4250	167.421875 167.428125
167.4375	167.434375 167.440625
167.4500	167.446875 167.453125
167.4625	167.459375 167.465625
167.4750	167.471875 167.478125
167.4875	167.484375 167.490625
167.5000	167.496875 167.503125
167.5125	167.509375 167.515625
167.5250	167.521875 167.528125
167.5375	167.534375 167.540625
167.5500	167.546875 167.553125
167.5625	167.559375 167.565625
167.5750	167.571875 167.578125
167.5875	167.584375 167.590625
167.6000	167.596875 167.603125
167.6125	167.609375 167.615625



TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
167.6250	167.621875
	167.628125
167.6375	167.634375
	167.640625
167.6500	167.646875
	167.653125
167.6625	167.659375
	167.665625
167.6750	167.671875
	167.678125
167.6875	167.684375
	167.690625
167.7000	167.696875
	167.703125
167.7125	167.709375
	167.715625
167.7250	167.721875
	167.728125
167.7375	167.734375
	167.740625
167.7500	167.746875
	167.753125
167.7625	167.759375
	167.765625
167.7750	167.771875
	167.778125
167.7875	167.784375
	167.790625
167.8000	167.796875
	167.803125
167.8125	167.809375
	167.815625
167.8250	167.821875
	167.828125
167.8375	167.834375
	167.840625
167.8500	167.846875
	167.853125
167.8625	167.859375
	167.865625
167.8750	167.871875
	167.878125
167.8875	167.884375
	167.890625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
167.9000	167.896875
	167.903125
167.9125	167.909375
	167.915625
167.9250	167.921875
	167.928125
167.9375	167.934375
	167.940625
167.9500	167.946875
	167.953125
167.9625	167.959375
	167.965625
167.9750	167.971875
	167.978125
167.9875	167.984375
	167.990625
168.0000	167.996875
	168.003125
168.0125	168.009375
	168.015625
168.0250	168.021875
	168.028125
168.0375	168.034375
	168.040625
168.0500	168.046875
	168.053125
168.0625	168.059375
	168.065625
168.0750	168.071875
	168.078125
168.0875	168.084375
	168.090625
168.1000	168.096875
	168.103125
168.1125	168.109375
	168.115625
168.1250	168.121875
	168.128125
168.1375	168.134375
	168.140625
168.1500	168.146875
	168.153125
168.1625	168.159375
	168.165625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
168.1750	168.171875
	168.178125
168.1875	168.184375
	168.190625
168.2000	168.196875
	168.203125
168.2125	168.209375
	168.215625
168.2250	168.221875
	168.228125
168.2375	168.234375
	168.240625
168.2500	168.246875
	168.253125
168.2625	168.259375
	168.265625
168.2750	168.271875
	168.278125
168.2875	168.284375
	168.290625
168.3000	168.296875
	168.303125
168.3125	168.309375
	168.315625
168.3250	168.321875
	168.328125
168.3375	168.334375
	168.340625
168.3500	168.346875
	168.353125
168.3625	168.359375
	168.365625
168.3750	168.371875
	168.378125
168.3875	168.384375
	168.390625
168.4000	168.396875
	168.403125
168.4125	168.409375
	168.415625
168.4250	168.421875
	168.428125
168.4375	168.434375
	168.440625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
168.4500	168.446875
	168.453125
168.4625	168.459375
	168.465625
168.4750	168.471875
	168.478125
168.4875	168.484375
	168.490625
168.5000	168.496875
	168.503125
168.5125	168.509375
	168.515625
168.5250	168.521875
	168.528125
168.5375	168.534375
	168.540625
168.5500	168.546875
	168.553125
168.5625	168.559375
	168.565625
168.5750	168.571875
	168.578125
168.5875	168.584375
	168.590625
168.6000	168.596875
	168.603125
168.6125	168.609375
	168.615625
168.6250	168.621875
	168.628125
168.6375	168.634375
	168.640625
168.6500	168.646875
	168.653125
168.6625	168.659375
	168.665625
168.6750	168.671875
	168.678125
168.6875	168.684375
	168.690625
168.7000	168.696875
	168.703125
168.7125	168.709375
	168.715625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
168.7250	168.721875
	168.728125
168.7375	168.734375
	168.740625
168.7500	168.746875
	168.753125
168.7625	168.759375
	168.765625
168.7750	168.771875
	168.778125
168.7875	168.784375
	168.790625
168.8000	168.796875
	168.803125
168.8125	168.809375
	168.815625
168.8250	168.821875
	168.828125
168.8375	168.834375
	168.840625
168.8500	168.846875
	168.853125
168.8625	168.859375
	168.865625
168.8750	168.871875
	168.878125
168.8875	168.884375
	168.890625
168.9000	168.896875
	168.903125
168.9125	168.909375
	168.915625
168.9250	168.921875
	168.928125
168.9375	168.934375
	168.940625
168.9500	168.946875
	168.953125
168.9625	168.959375
	168.965625
168.9750	168.971875
	168.978125
168.9875	168.984375
	168.990625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
169.0000	168.996875
	169.003125
169.0125	169.009375
	169.015625
169.0250	169.021875
	169.028125
169.0375	169.034375
	169.040625
169.0500	169.046875
	169.053125
169.0625	169.059375
	169.065625
169.0750	169.071875
	169.078125
169.0875	169.084375
	169.090625
169.1000	169.096875
	169.103125
169.1125	169.109375
	169.115625
169.1250	169.121875
	169.128125
169.1375	169.134375
	169.140625
169.1500	169.146875
	169.153125
169.1625	169.159375
	169.165625
169.1750	169.171875
	169.178125
169.1875	169.184375
	169.190625
169.2000	169.196875
	169.203125
169.2125	169.209375
	169.215625
169.2250	169.221875
	169.228125
169.2375	169.234375
	169.240625
169.2500	169.246875
	169.253125
169.2625	169.259375
	169.265625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
169.2750	169.271875
	169.278125
169.2875	169.284375
	169.290625
169.3000	169.296875
	169.303125
169.3125	169.309375
	169.315625
169.3250	169.321875
	169.328125
169.3375	169.334375
	169.340625
169.3500	169.346875
	169.353125
169.3625	169.359375
	169.365625
169.3750	169.371875
	169.378125
169.3875	169.384375
	169.390625

TABLE 2: Single Frequency Operations	
Center Frequency 12.5 kHz	Center Frequency 6.25 kHz
169.4000	169.396875
	169.403125
169.4125	169.409375
	169.415625
169.4250	169.421875
	169.428125
169.4375	169.434375
	169.440625
169.4500	169.446875
	169.453125
169.4625	169.459375
	169.465625
169.4750	169.471875
	169.478125
169.4875	169.484375
	169.490625
169.5000	169.496875
	169.503125

#### 4.3.8 Reserved

#### 4.3.9 Channeling Plan for Assignments in the Band 406.1-420 MHz

This plan is a guide for identifying center frequencies for assignments normally with necessary bandwidths of 6.25 or 12.5 kHz. This plan contains two tables, Table 1 contains center frequencies for channel pairs and Table 2 contains center frequencies for single frequency operations. This plan also includes conditions and limitation for use of assignments in the band 406.1-420 MHz. The addition of the 6.25 kHz channel spacing supports agencies purchasing equipment capable of using this bandwidth. There is no requirement for agencies to transition to 6.25 kHz Channels.

#### CONDITIONS AND LIMITATIONS

1. Transition. To allow for an orderly transition from previous channel plans to this plan, the following apply:

a. Agencies having assignments on or overlapping frequencies allotted for primary use by other agencies shall make every attempt to move their operations to frequencies allotted primarily for their own use, or to frequencies allotted for their shared use. Agencies must complete all moves by the earliest possible date.

b. Any wideband assignment authorized prior to December 31, 2007, and continued in use after that date, which is on or overlaps a narrowband frequency allotted for primary use by another agency, the using agency or agencies must vacate the assignment within 180 days of a

formal notice of requirement from the agency allotted the frequency. The notifying agency must demonstrate a valid requirement for the frequency and the FAS recommends the using agency vacate the assignment.

2. Narrowband Operations. Agencies may request narrowband assignments on the center frequencies shown in Table 1 and Table 2 for transmitters with necessary bandwidths less than 12.5 kHz. Agencies requesting new narrowband assignments adjacent to wideband assignments (bandwidths 12.5 kHz or greater), must consider that additional distance separation may be required due to the increased potential for adjacent channel interference, and then only after coordination/notification with affected agencies.

3. Wideband Operations. NTIA may authorize renewal of assignments to existing stations with necessary bandwidths of 12.5 kHz or greater. In addition, NTIA may authorize assignments for expansion of stations within existing networks operating with bandwidths of 12.5 kHz or greater, but all such assignments must bear Special Note S391 (see Annex A). By January 1, 2008, all assignments and equipment must conform to the provisions set forth in paragraph 1, above, and Section 5.3.5 of this Manual. The Automated Surface Observing System (ASOS) operations centered on frequencies 410.075 and 410.950 MHz may continue to operate with necessary bandwidths greater than 12.5 kHz, but less than 25 kHz. Exceptions to these rules may be authorized on a case-by-case basis, provided the assignment with bandwidth(s) of 12.5 kHz or greater is needed to satisfy requirements and , has been properly coordinated with all affected agencies, and has been recommended for approval by the FAS. However, the rule outlined in subparagraph 1.b, above, applies.

4. Use of Coded Squelch. Use coded squelch techniques whenever this technique will promote more efficient spectrum use (e.g., use of fewer frequencies, sharing frequencies, or reduction or elimination of interference).

5. Time Division Multiple Access (TDMA) Operations. TDMA systems with at least one voice channel per 12.5 kHz will be allowed and accommodated on adjacent 12.5 kHz center frequencies listed in this channeling plan. The center frequency of the TDMA emission must be offset midway between the center frequencies listed in this plan to limit adjacent channel interference problems with existing or planned narrowband operations. Refer to Section 5.3 of this Manual for technical details.

6. Paired Frequency Operations. Table 1 contains pairs of frequencies used primarily for two-frequency simplex operations using equipment operating with a necessary bandwidth less than 12.5 kHz.

a. For paired frequency operations, use the frequencies in the range 406.1125-410.9875 MHz for land station transmissions (or mobile receive), and use the frequencies in the range 415.1125-419.9875 MHz for land station receive (or mobile transmit).

b. Base stations can transmit with an operating power of 125 watts or less in the range 415.1125-419.9875 MHz to access a repeater.

c. Mobile stations are permitted to use repeater transmit frequencies for talk-around communications.

d. NTIA may authorize unpaired single frequency operations using either of the paired frequencies, except those allotted AGA, if the requesting agency believes it to be a more effective spectrum use. All such assignments must bear Special Note S396 (see Annex A). However, as long as an agency has assignments for unpaired single frequency operations on frequencies listed in Table 1, that agency shall not be authorized paired frequency assignments on those frequencies in Table 1 allotted AGA, unless justified.

e. Agencies will first propose frequency pairs allotted primarily for their own use from the Table 1 structure.

f. If there are no agency allotted structured pairs available, the requesting agency or agencies must propose frequency pairs allotted primarily for AGA use from the Table 1 structure.

g. If there are no AGA allotted structured pairs available, an agency may use any of their allotted frequencies in the range 406.1125-410.9875 MHz and any of their allotted frequencies in the range 415.1125-419.9875 MHz to make up a single channel pair. This is if the requesting agency believes this is more effective spectrum use and if it complies, in part with the provisions of paragraph 6.a.

h. If a channel pair cannot be found from the transmit and receive ranges, an agency may use any of their allotted frequencies in the range 406.1125-410.9875 MHz and any of their allotted frequencies in the ranges 411.000-415.1000 MHz or 415.1125-419.9875 MHz to make up a single channel pair. This is if the requesting agency believes this to be more effective spectrum use.

i. Existing narrowband assignments that do not conform to the provisions of this paragraph are grandfathered until January 1, 2022. Additionally, authorizations expanding existing narrowband systems will continue within this period.

7. Single Frequency Operations. Table 2 contains the center frequencies used for single frequency operations with necessary bandwidths less than 12.5 kHz.

8. Use of the Band by Military Agencies. Use of the band 406.1-420 MHz by the military agencies is limited to non-tactical or intra-base radio operations with the following provisions:

a. frequency assignments may be authorized on center frequencies allotted primarily for DOD;

b. frequency assignments for certified trunked systems may be authorized on the center frequencies allotted primarily for non-military agencies or AGA, subject to the conditions imposed on the NTIA certification of spectrum support and coordination between the affected agencies. The priority note P076 shall be applied to assignments on center frequencies allotted primarily for non-military agencies and those allotted for shared use, unless the agency(ies) to which the frequency is primarily allotted agrees to waive this requirement.; and,

c. frequency assignments for purposes other than trunked systems may be authorized on the center frequencies allotted primarily for non-military agencies or AGA, provided the proper selection and coordination procedures have been followed, and provided the priority note P076 is applied to each such assignment.

**Table 1: Paired Channels**

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
406.1125	406.109375	415.1125	415.109375
	406.115625		415.115625
406.1250	406.121875	415.1250	415.121875
	406.128125		415.128125
406.1375	406.134375	415.1375	415.134375
	406.140625		415.140625
406.1500	406.146875	415.1500	415.146875
	406.153125		415.153125
406.1625	406.159375	415.1625	415.159375
	406.165625		415.165625
406.1750	406.171875	415.1750	415.171875
	406.178125		415.178125
406.1875	406.184375	415.1875	415.184375
	406.190625		415.190625
406.2000	406.196875	415.2000	415.196875
	406.203125		415.203125
406.2125	406.209375	415.2125	415.209375
	406.215625		415.215625
406.2250	406.221875	415.2250	415.221875
	406.228125		415.228125
406.2375	406.234375	415.2375	415.234375
	406.240625		415.240625
406.2500	406.246875	415.2500	415.246875
	406.253125		415.253125
406.2625	406.259375	415.2625	415.259375
	406.265625		415.265625
406.2750	406.271875	415.2750	415.271875
	406.278125		415.278125
406.2875	406.284375	415.2875	415.284375
	406.290625		415.290625
406.3000	406.296875	415.3000	415.296875
	406.303125		415.303125
406.3125	406.309375	415.3125	415.309375
	406.315625		415.315625
406.3250	406.321875	415.3250	415.321875
	406.328125		415.328125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
406.3375	406.334375	415.3375	415.334375
	406.340625		415.340625
406.3500	406.346875	415.3500	415.346875
	406.353125		415.353125
406.3625	406.359375	415.3625	415.359375
	406.365625		415.365625
406.3750	406.371875	415.3750	415.371875
	406.378125		415.378125
406.3875	406.384375	415.3875	415.384375
	406.390625		415.390625
406.4000	406.396875	415.4000	415.396875
	406.403125		415.403125
406.4125	406.409375	415.4125	415.409375
	406.415625		415.415625
406.4250	406.421875	415.4250	415.421875
	406.428125		415.428125
406.4375	406.434375	415.4375	415.434375
	406.440625		415.440625
406.4500	406.446875	415.4500	415.446875
	406.453125		415.453125
406.4625	406.459375	415.4625	415.459375
	406.465625		415.465625
406.4750	406.471875	415.4750	415.471875
	406.478125		415.478125
406.4875	406.484375	415.4875	415.484375
	406.490625		415.490625
406.5000	406.496875	415.5000	415.496875
	406.503125		415.503125
406.5125	406.509375	415.5125	415.509375
	406.515625		415.515625
406.5250	406.521875	415.5250	415.521875
	406.528125		415.528125
406.5375	406.534375	415.5375	415.534375
	406.540625		415.540625
406.5500	406.546875	415.5500	415.546875
	406.553125		415.553125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
406.5625	406.559375	415.5625	415.559375
	406.565625		415.565625
406.5750	406.571875	415.5750	415.571875
	406.578125		415.578125
406.5875	406.584375	415.5875	415.584375
	406.590625		415.590625
406.6000	406.596875	415.6000	415.596875
	406.603125		415.603125
406.6125	406.609375	415.6125	415.609375
	406.615625		415.615625
406.6250	406.621875	415.6250	415.621875
	406.628125		415.628125
406.6375	406.634375	415.6375	415.634375
	406.640625		415.640625
406.6500	406.646875	415.6500	415.646875
	406.653125		415.653125
406.6625	406.659375	415.6625	415.659375
	406.665625		415.665625
406.6750	406.671875	415.6750	415.671875
	406.678125		415.678125
406.6875	406.684375	415.6875	415.684375
	406.690625		415.690625
406.7000	406.696875	415.7000	415.696875
	406.703125		415.703125
406.7125	406.709375	415.7125	415.709375
	406.715625		415.715625
406.7250	406.721875	415.7250	415.721875
	406.728125		415.728125
406.7375	406.734375	415.7375	415.734375
	406.740625		415.740625
406.7500	406.746875	415.7500	415.746875
	406.753125		415.753125
406.7625	406.759375	415.7625	415.759375
	406.765625		415.765625
406.7750	406.771875	415.7750	415.771875
	406.778125		415.778125
406.7875	406.784375	415.7875	415.784375
	406.790625		415.790625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
406.8000	406.796875	415.8000	415.796875
	406.803125		415.803125
406.8125	406.809375	415.8125	415.809375
	406.815625		415.815625
406.8250	406.821875	415.8250	415.821875
	406.828125		415.828125
406.8375	406.834375	415.8375	415.834375
	406.840625		415.840625
406.8500	406.846875	415.8500	415.846875
	406.853125		415.853125
406.8625	406.859375	415.8625	415.859375
	406.865625		415.865625
406.8750	406.871875	415.8750	415.871875
	406.878125		415.878125
406.8875	406.884375	415.8875	415.884375
	406.890625		415.890625
406.9000	406.896875	415.9000	415.896875
	406.903125		415.903125
406.9125	406.909375	415.9125	415.909375
	406.915625		415.915625
406.9250	406.921875	415.9250	415.921875
	406.928125		415.928125
406.9375	406.934375	415.9375	415.934375
	406.940625		415.940625
406.9500	406.946875	415.9500	415.946875
	406.953125		415.953125
406.9625	406.959375	415.9625	415.959375
	406.965625		415.965625
406.9750	406.971875	415.9750	415.971875
	406.978125		415.978125
406.9875	406.984375	415.9875	415.984375
	406.990625		415.990625
407.0000	406.996875	416.0000	415.996875
	407.003125		416.003125
407.0125	407.009375	416.0125	416.009375
	407.015625		416.015625
407.0250	407.021875	416.0250	416.021875
	407.028125		416.028125



TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
407.0375	407.034375	416.0375	416.034375
	407.040625		416.040625
407.0500	407.046875	416.0500	416.046875
	407.053125		416.053125
407.0625	407.059375	416.0625	416.059375
	407.065625		416.065625
407.0750	407.071875	416.0750	416.071875
	407.078125		416.078125
407.0875	407.084375	416.0875	416.084375
	407.090625		416.090625
407.1000	407.096875	416.1000	416.096875
	407.103125		416.103125
407.1125	407.109375	416.1125	416.109375
	407.115625		416.115625
407.1250	407.121875	416.1250	416.121875
	407.128125		416.128125
407.1375	407.134375	416.1375	416.134375
	407.140625		416.140625
407.1500	407.146875	416.1500	416.146875
	407.153125		416.153125
407.1625	407.159375	416.1625	416.159375
	407.165625		416.165625
407.1750	407.171875	416.1750	416.171875
	407.178125		416.178125
407.1875	407.184375	416.1875	416.184375
	407.190625		416.190625
407.2000	407.196875	416.2000	416.196875
	407.203125		416.203125
407.2125	407.209375	416.2125	416.209375
	407.215625		416.215625
407.2250	407.221875	416.2250	416.221875
	407.228125		416.228125
407.2375	407.234375	416.2375	416.234375
	407.240625		416.240625
407.2500	407.246875	416.2500	416.246875
	407.253125		416.253125
407.2625	407.259375	416.2625	416.259375
	407.265625		416.265625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
407.2750	407.271875	416.2750	416.271875
	407.278125		416.278125
407.2875	407.284375	416.2875	416.284375
	407.290625		416.290625
407.3000	407.296875	416.3000	416.296875
	407.303125		416.303125
407.3125	407.309375	416.3125	416.309375
	407.315625		416.315625
407.3250	407.321875	416.3250	416.321875
	407.328125		416.328125
407.3375	407.334375	416.3375	416.334375
	407.340625		416.340625
407.3500	407.346875	416.3500	416.346875
	407.353125		416.353125
407.3625	407.359375	416.3625	416.359375
	407.365625		416.365625
407.3750	407.371875	416.3750	416.371875
	407.378125		416.378125
407.3875	407.384375	416.3875	416.384375
	407.390625		416.390625
407.4000	407.396875	416.4000	416.396875
	407.403125		416.403125
407.4125	407.409375	416.4125	416.409375
	407.415625		416.415625
407.4250	407.421875	416.4250	416.421875
	407.428125		416.428125
407.4375	407.434375	416.4375	416.434375
	407.440625		416.440625
407.4500	407.446875	416.4500	416.446875
	407.453125		416.453125
407.4625	407.459375	416.4625	416.459375
	407.465625		416.465625
407.4750	407.471875	416.4750	416.471875
	407.478125		416.478125
407.4875	407.484375	416.4875	416.484375
	407.490625		416.490625
407.5000	407.496875	416.5000	416.496875
	407.503125		416.503125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
407.5125	407.509375	416.5125	416.509375
	407.515625		416.515625
407.5250	407.521875	416.5250	416.521875
	407.528125		416.528125
407.5375	407.534375	416.5375	416.534375
	407.540625		416.540625
407.5500	407.546875	416.5500	416.546875
	407.553125		416.553125
407.5625	407.559375	416.5625	416.559375
	407.565625		416.565625
407.5750	407.571875	416.5750	416.571875
	407.578125		416.578125
407.5875	407.584375	416.5875	416.584375
	407.590625		416.590625
407.6000	407.596875	416.6000	416.596875
	407.603125		416.603125
407.6125	407.609375	416.6125	416.609375
	407.615625		416.615625
407.6250	407.621875	416.6250	416.621875
	407.628125		416.628125
407.6375	407.634375	416.6375	416.634375
	407.640625		416.640625
407.6500	407.646875	416.6500	416.646875
	407.653125		416.653125
407.6625	407.659375	416.6625	416.659375
	407.665625		416.665625
407.6750	407.671875	416.6750	416.671875
	407.678125		416.678125
407.6875	407.684375	416.6875	416.684375
	407.690625		416.690625
407.7000	407.696875	416.7000	416.696875
	407.703125		416.703125
407.7125	407.709375	416.7125	416.709375
	407.715625		416.715625
407.7250	407.721875	416.7250	416.721875
	407.728125		416.728125
407.7375	407.734375	416.7375	416.734375
	407.740625		416.740625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
407.7500	407.746875	416.7500	416.746875
	407.753125		416.753125
407.7625	407.759375	416.7625	416.759375
	407.765625		416.765625
407.7750	407.771875	416.7750	416.771875
	407.778125		416.778125
407.7875	407.784375	416.7875	416.784375
	407.790625		416.790625
407.8000	407.796875	416.8000	416.796875
	407.803125		416.803125
407.8125	407.809375	416.8125	416.809375
	407.815625		416.815625
407.8250	407.821875	416.8250	416.821875
	407.828125		416.828125
407.8375	407.834375	416.8375	416.834375
	407.840625		416.840625
407.8500	407.846875	416.8500	416.846875
	407.853125		416.853125
407.8625	407.859375	416.8625	416.859375
	407.865625		416.865625
407.8750	407.871875	416.8750	416.871875
	407.878125		416.878125
407.8875	407.884375	416.8875	416.884375
	407.890625		416.890625
407.9000	407.896875	416.9000	416.896875
	407.903125		416.903125
407.9125	407.909375	416.9125	416.909375
	407.915625		416.915625
407.9250	407.921875	416.9250	416.921875
	407.928125		416.928125
407.9375	407.934375	416.9375	416.934375
	407.940625		416.940625
407.9500	407.946875	416.9500	416.946875
	407.953125		416.953125
407.9625	407.959375	416.9625	416.959375
	407.965625		416.965625
407.9750	407.971875	416.9750	416.971875
	407.978125		416.978125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
407.9875	407.984375	416.9875	416.984375
	407.990625		416.990625
408.0000	407.996875	417.0000	416.996875
	408.003125		417.003125
408.0125	408.009375	417.0125	417.009375
	408.015625		417.015625
408.0250	408.021875	417.0250	417.021875
	408.028125		417.028125
408.0375	408.034375	417.0375	417.034375
	408.040625		417.040625
408.0500	408.046875	417.0500	417.046875
	408.053125		417.053125
408.0625	408.059375	417.0625	417.059375
	408.065625		417.065625
408.0750	408.071875	417.0750	417.071875
	408.078125		417.078125
408.0875	408.084375	417.0875	417.084375
	408.090625		417.090625
408.1000	408.096875	417.1000	417.096875
	408.103125		417.103125
408.1125	408.109375	417.1125	417.109375
	408.115625		417.115625
408.1250	408.121875	417.1250	417.121875
	408.128125		417.128125
408.1375	408.134375	417.1375	417.134375
	408.140625		417.140625
408.1500	408.146875	417.1500	417.146875
	408.153125		417.153125
408.1625	408.159375	417.1625	417.159375
	408.165625		417.165625
408.1750	408.171875	417.1750	417.171875
	408.178125		417.178125
408.1875	408.184375	417.1875	417.184375
	408.190625		417.190625
408.2000	408.196875	417.2000	417.196875
	408.203125		417.203125
408.2125	408.209375	417.2125	417.209375
	408.215625		417.215625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
408.2250	408.221875	417.2250	417.221875
	408.228125		417.228125
408.2375	408.234375	417.2375	417.234375
	408.240625		417.240625
408.2500	408.246875	417.2500	417.246875
	408.253125		417.253125
408.2625	408.259375	417.2625	417.259375
	408.265625		417.265625
408.2750	408.271875	417.2750	417.271875
	408.278125		417.278125
408.2875	408.284375	417.2875	417.284375
	408.290625		417.290625
408.3000	408.296875	417.3000	417.296875
	408.303125		417.303125
408.3125	408.309375	417.3125	417.309375
	408.315625		417.315625
408.3250	408.321875	417.3250	417.321875
	408.328125		417.328125
408.3375	408.334375	417.3375	417.334375
	408.340625		417.340625
408.3500	408.346875	417.3500	417.346875
	408.353125		417.353125
408.3625	408.359375	417.3625	417.359375
	408.365625		417.365625
408.3750	408.371875	417.3750	417.371875
	408.378125		417.378125
408.3875	408.384375	417.3875	417.384375
	408.390625		417.390625
408.4000	408.396875	417.4000	417.396875
	408.403125		417.403125
408.4125	408.409375	417.4125	417.409375
	408.415625		417.415625
408.4250	408.421875	417.4250	417.421875
	408.428125		417.428125
408.4375	408.434375	417.4375	417.434375
	408.440625		417.440625
408.4500	408.446875	417.4500	417.446875
	408.453125		417.453125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
408.4625	408.459375	417.4625	417.459375
	408.465625		417.465625
408.4750	408.471875	417.4750	417.471875
	408.478125		417.478125
408.4875	408.484375	417.4875	417.484375
	408.490625		417.490625
408.5000	408.496875	417.5000	417.496875
	408.503125		417.503125
408.5125	408.509375	417.5125	417.509375
	408.515625		417.515625
408.5250	408.521875	417.5250	417.521875
	408.528125		417.528125
408.5375	408.534375	417.5375	417.534375
	408.540625		417.540625
408.5500	408.546875	417.5500	417.546875
	408.553125		417.553125
408.5625	408.559375	417.5625	417.559375
	408.565625		417.565625
408.5750	408.571875	417.5750	417.571875
	408.578125		417.578125
408.5875	408.584375	417.5875	417.584375
	408.590625		417.590625
408.6000	408.596875	417.6000	417.596875
	408.603125		417.603125
408.6125	408.609375	417.6125	417.609375
	408.615625		417.615625
408.6250	408.621875	417.6250	417.621875
	408.628125		417.628125
408.6375	408.634375	417.6375	417.634375
	408.640625		417.640625
408.6500	408.646875	417.6500	417.646875
	408.653125		417.653125
408.6625	408.659375	417.6625	417.659375
	408.665625		417.665625
408.6750	408.671875	417.6750	417.671875
	408.678125		417.678125
408.6875	408.684375	417.6875	417.684375
	408.690625		417.690625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
408.7000	408.696875	417.7000	417.696875
	408.703125		417.703125
408.7125	408.709375	417.7125	417.709375
	408.715625		417.715625
408.7250	408.721875	417.7250	417.721875
	408.728125		417.728125
408.7375	408.734375	417.7375	417.734375
	408.740625		417.740625
408.7500	408.746875	417.7500	417.746875
	408.753125		417.753125
408.7625	408.759375	417.7625	417.759375
	408.765625		417.765625
408.7750	408.771875	417.7750	417.771875
	408.778125		417.778125
408.7875	408.784375	417.7875	417.784375
	408.790625		417.790625
408.8000	408.796875	417.8000	417.796875
	408.803125		417.803125
408.8125	408.809375	417.8125	417.809375
	408.815625		417.815625
408.8250	408.821875	417.8250	417.821875
	408.828125		417.828125
408.8375	408.834375	417.8375	417.834375
	408.840625		417.840625
408.8500	408.846875	417.8500	417.846875
	408.853125		417.853125
408.8625	408.859375	417.8625	417.859375
	408.865625		417.865625
408.8750	408.871875	417.8750	417.871875
	408.878125		417.878125
408.8875	408.884375	417.8875	417.884375
	408.890625		417.890625
408.9000	408.896875	417.9000	417.896875
	408.903125		417.903125
408.9125	408.909375	417.9125	417.909375
	408.915625		417.915625
408.9250	408.921875	417.9250	417.921875
	408.928125		417.928125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
408.9375	408.934375	417.9375	417.934375
	408.940625		417.940625
408.9500	408.946875	417.9500	417.946875
	408.953125		417.953125
408.9625	408.959375	417.9625	417.959375
	408.965625		417.965625
408.9750	408.971875	417.9750	417.971875
	408.978125		417.978125
408.9875	408.984375	417.9875	417.984375
	408.990625		417.990625
409.0000	408.996875	418.0000	417.996875
	409.003125		418.003125
409.0125	409.009375	418.0125	418.009375
	409.015625		418.015625
409.0250	409.021875	418.0250	418.021875
	409.028125		418.028125
409.0375	409.034375	418.0375	418.034375
	409.040625		418.040625
409.0500	409.046875	418.0500	418.046875
	409.053125		418.053125
409.0625	409.059375	418.0625	418.059375
	409.065625		418.065625
409.0750	409.071875	418.0750	418.071875
	409.078125		418.078125
409.0875	409.084375	418.0875	418.084375
	409.090625		418.090625
409.1000	409.096875	418.1000	418.096875
	409.103125		418.103125
409.1125	409.109375	418.1125	418.109375
	409.115625		418.115625
409.1250	409.121875	418.1250	418.121875
	409.128125		418.128125
409.1375	409.134375	418.1375	418.134375
	409.140625		418.140625
409.1500	409.146875	418.1500	418.146875
	409.153125		418.153125
409.1625	409.159375	418.1625	418.159375
	409.165625		418.165625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
409.1750	409.171875	418.1750	418.171875
	409.178125		418.178125
409.1875	409.184375	418.1875	418.184375
	409.190625		418.190625
409.2000	409.196875	418.2000	418.196875
	409.203125		418.203125
409.2125	409.209375	418.2125	418.209375
	409.215625		418.215625
409.2250	409.221875	418.2250	418.221875
	409.228125		418.228125
409.2375	409.234375	418.2375	418.234375
	409.240625		418.240625
409.2500	409.246875	418.2500	418.246875
	409.253125		418.253125
409.2625	409.259375	418.2625	418.259375
	409.265625		418.265625
409.2750	409.271875	418.2750	418.271875
	409.278125		418.278125
409.2875	409.284375	418.2875	418.284375
	409.290625		418.290625
409.3000	409.296875	418.3000	418.296875
	409.303125		418.303125
409.3125	409.309375	418.3125	418.309375
	409.315625		418.315625
409.3250	409.321875	418.3250	418.321875
	409.328125		418.328125
409.3375	409.334375	418.3375	418.334375
	409.340625		418.340625
409.3500	409.346875	418.3500	418.346875
	409.353125		418.353125
409.3625	409.359375	418.3625	418.359375
	409.365625		418.365625
409.3750	409.371875	418.3750	418.371875
	409.378125		418.378125
409.3875	409.384375	418.3875	418.384375
	409.390625		418.390625
409.4000	409.396875	418.4000	418.396875
	409.403125		418.403125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
409.4125	409.409375	418.4125	418.409375
	409.415625		418.415625
409.4250	409.421875	418.4250	418.421875
	409.428125		418.428125
409.4375	409.434375	418.4375	418.434375
	409.440625		418.440625
409.4500	409.446875	418.4500	418.446875
	409.453125		418.453125
409.4625	409.459375	418.4625	418.459375
	409.465625		418.465625
409.4750	409.471875	418.4750	418.471875
	409.478125		418.478125
409.4875	409.484375	418.4875	418.484375
	409.490625		418.490625
409.5000	409.496875	418.5000	418.496875
	409.503125		418.503125
409.5125	409.509375	418.5125	418.509375
	409.515625		418.515625
409.5250	409.521875	418.5250	418.521875
	409.528125		418.528125
409.5375	409.534375	418.5375	418.534375
	409.540625		418.540625
409.5500	409.546875	418.5500	418.546875
	409.553125		418.553125
409.5625	409.559375	418.5625	418.559375
	409.565625		418.565625
409.5750	409.571875	418.5750	418.571875
	409.578125		418.578125
409.5875	409.584375	418.5875	418.584375
	409.590625		418.590625
409.6000	409.596875	418.6000	418.596875
	409.603125		418.603125
409.6125	409.609375	418.6125	418.609375
	409.615625		418.615625
409.6250	409.621875	418.6250	418.621875
	409.628125		418.628125
409.6375	409.634375	418.6375	418.634375
	409.640625		418.640625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
409.6500	409.646875	418.6500	418.646875
	409.653125		418.653125
409.6625	409.659375	418.6625	418.659375
	409.665625		418.665625
409.6750	409.671875	418.6750	418.671875
	409.678125		418.678125
409.6875	409.684375	418.6875	418.684375
	409.690625		418.690625
409.7000	409.696875	418.7000	418.696875
	409.703125		418.703125
409.7125	409.709375	418.7125	418.709375
	409.715625		418.715625
409.7250	409.721875	418.7250	418.721875
	409.728125		418.728125
409.7375	409.734375	418.7375	418.734375
	409.740625		418.740625
409.7500	409.746875	418.7500	418.746875
	409.753125		418.753125
409.7625	409.759375	418.7625	418.759375
	409.765625		418.765625
409.7750	409.771875	418.7750	418.771875
	409.778125		418.778125
409.7875	409.784375	418.7875	418.784375
	409.790625		418.790625
409.8000	409.796875	418.8000	418.796875
	409.803125		418.803125
409.8125	409.809375	418.8125	418.809375
	409.815625		418.815625
409.8250	409.821875	418.8250	418.821875
	409.828125		418.828125
409.8375	409.834375	418.8375	418.834375
	409.840625		418.840625
409.8500	409.846875	418.8500	418.846875
	409.853125		418.853125
409.8625	409.859375	418.8625	418.859375
	409.865625		418.865625
409.8750	409.871875	418.8750	418.871875
	409.878125		418.878125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
409.8875	409.884375	418.8875	418.884375
	409.890625		418.890625
409.9000	409.896875	418.9000	418.896875
	409.903125		418.903125
409.9125	409.909375	418.9125	418.909375
	409.915625		418.915625
409.9250	409.921875	418.9250	418.921875
	409.928125		418.928125
409.9375	409.934375	418.9375	418.934375
	409.940625		418.940625
409.9500	409.946875	418.9500	418.946875
	409.953125		418.953125
409.9625	409.959375	418.9625	418.959375
	409.965625		418.965625
409.9750	409.971875	418.9750	418.971875
	409.978125		418.978125
409.9875	409.984375	418.9875	418.984375
	409.990625		418.990625
410.0000	409.996875	419.0000	418.996875
	410.003125		419.003125
410.0125	410.009375	419.0125	419.009375
	410.015625		419.015625
410.0250	410.021875	419.0250	419.021875
	410.028125		419.028125
410.0375	410.034375	419.0375	419.034375
	410.040625		419.040625
410.0500	410.046875	419.0500	419.046875
	410.053125		419.053125
410.0625	410.059375	419.0625	419.059375
	410.065625		419.065625
410.0750	410.071875	419.0750	419.071875
	410.078125		419.078125
410.0875	410.084375	419.0875	419.084375
	410.090625		419.090625
410.1000	410.096875	419.1000	419.096875
	410.103125		419.103125
410.1125	410.109375	419.1125	419.109375
	410.115625		419.115625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
410.1250	410.121875	419.1250	419.121875
	410.128125		419.128125
410.1375	410.134375	419.1375	419.134375
	410.140625		419.140625
410.1500	410.146875	419.1500	419.146875
	410.153125		419.153125
410.1625	410.159375	419.1625	419.159375
	410.165625		419.165625
410.1750	410.171875	419.1750	419.171875
	410.178125		419.178125
410.1875	410.184375	419.1875	419.184375
	410.190625		419.190625
410.2000	410.196875	419.2000	419.196875
	410.203125		419.203125
410.2125	410.209375	419.2125	419.209375
	410.215625		419.215625
410.2250	410.221875	419.2250	419.221875
	410.228125		419.228125
410.2375	410.234375	419.2375	419.234375
	410.240625		419.240625
410.2500	410.246875	419.2500	419.246875
	410.253125		419.253125
410.2625	410.259375	419.2625	419.259375
	410.265625		419.265625
410.2750	410.271875	419.2750	419.271875
	410.278125		419.278125
410.2875	410.284375	419.2875	419.284375
	410.290625		419.290625
410.3000	410.296875	419.3000	419.296875
	410.303125		419.303125
410.3125	410.309375	419.3125	419.309375
	410.315625		419.315625
410.3250	410.321875	419.3250	419.321875
	410.328125		419.328125
410.3375	410.334375	419.3375	419.334375
	410.340625		419.340625
410.3500	410.346875	419.3500	419.346875
	410.353125		419.353125

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
410.3625	410.359375	419.3625	419.359375
	410.365625		419.365625
410.3750	410.371875	419.3750	419.371875
	410.378125		419.378125
410.3875	410.384375	419.3875	419.384375
	410.390625		419.390625
410.4000	410.396875	419.4000	419.396875
	410.403125		419.403125
410.4125	410.409375	419.4125	419.409375
	410.415625		419.415625
410.4250	410.421875	419.4250	419.421875
	410.428125		419.428125
410.4375	410.434375	419.4375	419.434375
	410.440625		419.440625
410.4500	410.446875	419.4500	419.446875
	410.453125		419.453125
410.4625	410.459375	419.4625	419.459375
	410.465625		419.465625
410.4750	410.471875	419.4750	419.471875
	410.478125		419.478125
410.4875	410.484375	419.4875	419.484375
	410.490625		419.490625
410.5000	410.496875	419.5000	419.496875
	410.503125		419.503125
410.5125	410.509375	419.5125	419.509375
	410.515625		419.515625
410.5250	410.521875	419.5250	419.521875
	410.528125		419.528125
410.5375	410.534375	419.5375	419.534375
	410.540625		419.540625
410.5500	410.546875	419.5500	419.546875
	410.553125		419.553125
410.5625	410.559375	419.5625	419.559375
	410.565625		419.565625
410.5750	410.571875	419.5750	419.571875
	410.578125		419.578125
410.5875	410.584375	419.5875	419.584375
	410.590625		419.590625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
410.6000	410.596875	419.6000	419.596875
	410.603125		419.603125
410.6125	410.609375	419.6125	419.609375
	410.615625		419.615625
410.6250	410.621875	419.6250	419.621875
	410.628125		419.628125
410.6375	410.634375	419.6375	419.634375
	410.640625		419.640625
410.6500	410.646875	419.6500	419.646875
	410.653125		419.653125
410.6625	410.659375	419.6625	419.659375
	410.665625		419.665625
410.6750	410.671875	419.6750	419.671875
	410.678125		419.678125
410.6875	410.684375	419.6875	419.684375
	410.690625		419.690625
410.7000	410.696875	419.7000	419.696875
	410.703125		419.703125
410.7125	410.709375	419.7125	419.709375
	410.715625		419.715625
410.7250	410.721875	419.7250	419.721875
	410.728125		419.728125
410.7375	410.734375	419.7375	419.734375
	410.740625		419.740625
410.7500	410.746875	419.7500	419.746875
	410.753125		419.753125
410.7625	410.759375	419.7625	419.759375
	410.765625		419.765625
410.7750	410.771875	419.7750	419.771875
	410.778125		419.778125
410.7875	410.784375	419.7875	419.784375
	410.790625		419.790625
410.8000	410.796875	419.8000	419.796875
	410.803125		419.803125
410.8125	410.809375	419.8125	419.809375
	410.815625		419.815625
410.8250	410.821875	419.8250	419.821875
	410.828125		419.828125



TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
410.8375	410.834375	419.8375	419.834375
	410.840625		419.840625
410.8500	410.846875	419.8500	419.846875
	410.853125		419.853125
410.8625	410.859375	419.8625	419.859375
	410.865625		419.865625
410.8750	410.871875	419.8750	419.871875
	410.878125		419.878125
410.8875	410.884375	419.8875	419.884375
	410.890625		419.890625
410.9000	410.896875	419.9000	419.896875
	410.903125		419.903125
410.9125	410.909375	419.9125	419.909375
	410.915625		419.915625

TABLE 1: Paired Channels			
Center Frequency 12.5KHz	Center Frequency 6.25KHz	Center Frequency 12.5KHz	Center Frequency 6.25KHz
410.9250	410.921875	419.9250	419.921875
	410.928125		419.928125
410.9375	410.934375	419.9375	419.934375
	410.940625		419.940625
410.9500	410.946875	419.9500	419.946875
	410.953125		419.953125
410.9625	410.959375	419.9625	419.959375
	410.965625		419.965625
410.9750	410.971875	419.9750	419.971875
	410.978125		419.978125
410.9875	410.984375	419.9875	419.984375
	410.990625		419.990625

**Table 2: Single Channels**

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
411.0000	410.996875
	411.003125
411.0125	411.009375
	411.015625
411.0250	411.021875
	411.028125
411.0375	411.034375
	411.040625
411.0500	411.046875
	411.053125
411.0625	411.059375
	411.065625
411.0750	411.071875
	411.078125
411.0875	411.084375
	411.090625
411.1000	411.096875
	411.103125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
411.1125	411.109375
	411.115625
411.1250	411.121875
	411.128125
411.1375	411.134375
	411.140625
411.1500	411.146875
	411.153125
411.1625	411.159375
	411.165625
411.1750	411.171875
	411.178125
411.1875	411.184375
	411.190625
411.2000	411.196875
	411.203125
411.2125	411.209375
	411.215625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
411.2250	411.221875
	411.228125
411.2375	411.234375
	411.240625
411.2500	411.246875
	411.253125
411.2625	411.259375
	411.265625
411.2750	411.271875
	411.278125
411.2875	411.284375
	411.290625
411.3000	411.296875
	411.303125
411.3125	411.309375
	411.315625
411.3250	411.321875
	411.328125
411.3375	411.334375
	411.340625
411.3500	411.346875
	411.353125
411.3625	411.359375
	411.365625
411.3750	411.371875
	411.378125
411.3875	411.384375
	411.390625
411.4000	411.396875
	411.403125
411.4125	411.409375
	411.415625
411.4250	411.421875
	411.428125
411.4375	411.434375
	411.440625
411.4500	411.446875
	411.453125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
411.4625	411.459375
	411.465625
411.4750	411.471875
	411.478125
411.4875	411.484375
	411.490625
411.5000	411.496875
	411.503125
411.5125	411.509375
	411.515625
411.5250	411.521875
	411.528125
411.5375	411.534375
	411.540625
411.5500	411.546875
	411.553125
411.5625	411.559375
	411.565625
411.5750	411.571875
	411.578125
411.5875	411.584375
	411.590625
411.6000	411.596875
	411.603125
411.6125	411.609375
	411.615625
411.6250	411.621875
	411.628125
411.6375	411.634375
	411.640625
411.6500	411.646875
	411.653125
411.6625	411.659375
	411.665625
411.6750	411.671875
	411.678125
411.6875	411.684375
	411.690625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
411.7000	411.696875
	411.703125
411.7125	411.709375
	411.715625
411.7250	411.721875
	411.728125
411.7375	411.734375
	411.740625
411.7500	411.746875
	411.753125
411.7625	411.759375
	411.765625
411.7750	411.771875
	411.778125
411.7875	411.784375
	411.790625
411.8000	411.796875
	411.803125
411.8125	411.809375
	411.815625
411.8250	411.821875
	411.828125
411.8375	411.834375
	411.840625
411.8500	411.846875
	411.853125
411.8625	411.859375
	411.865625
411.8750	411.871875
	411.878125
411.8875	411.884375
	411.890625
411.9000	411.896875
	411.903125
411.9125	411.909375
	411.915625
411.9250	411.921875
	411.928125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
411.9375	411.934375
	411.940625
411.9500	411.946875
	411.953125
411.9625	411.959375
	411.965625
411.9750	411.971875
	411.978125
411.9875	411.984375
	411.990625
412.0000	411.996875
	412.003125
412.0125	412.009375
	412.015625
412.0250	412.021875
	412.028125
412.0375	412.034375
	412.040625
412.0500	412.046875
	412.053125
412.0625	412.059375
	412.065625
412.0750	412.071875
	412.078125
412.0875	412.084375
	412.090625
412.1000	412.096875
	412.103125
412.1125	412.109375
	412.115625
412.1250	412.121875
	412.128125
412.1375	412.134375
	412.140625
412.1500	412.146875
	412.153125
412.1625	412.159375
	412.165625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
412.1750	412.171875
	412.178125
412.1875	412.184375
	412.190625
412.2000	412.196875
	412.203125
412.2125	412.209375
	412.215625
412.2250	412.221875
	412.228125
412.2375	412.234375
	412.240625
412.2500	412.246875
	412.253125
412.2625	412.259375
	412.265625
412.2750	412.271875
	412.278125
412.2875	412.284375
	412.290625
412.3000	412.296875
	412.303125
412.3125	412.309375
	412.315625
412.3250	412.321875
	412.328125
412.3375	412.334375
	412.340625
412.3500	412.346875
	412.353125
412.3625	412.359375
	412.365625
412.3750	412.371875
	412.378125
412.3875	412.384375
	412.390625
412.4000	412.396875
	412.403125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
412.4125	412.409375
	412.415625
412.4250	412.421875
	412.428125
412.4375	412.434375
	412.440625
412.4500	412.446875
	412.453125
412.4625	412.459375
	412.465625
412.4750	412.471875
	412.478125
412.4875	412.484375
	412.490625
412.5000	412.496875
	412.503125
412.5125	412.509375
	412.515625
412.5250	412.521875
	412.528125
412.5375	412.534375
	412.540625
412.5500	412.546875
	412.553125
412.5625	412.559375
	412.565625
412.5750	412.571875
	412.578125
412.5875	412.584375
	412.590625
412.6000	412.596875
	412.603125
412.6125	412.609375
	412.615625
412.6250	412.621875
	412.628125
412.6375	412.634375
	412.640625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
412.6500	412.646875
	412.653125
412.6625	412.659375
	412.665625
412.6750	412.671875
	412.678125
412.6875	412.684375
	412.690625
412.7000	412.696875
	412.703125
412.7125	412.709375
	412.715625
412.7250	412.721875
	412.728125
412.7375	412.734375
	412.740625
412.7500	412.746875
	412.753125
412.7625	412.759375
	412.765625
412.7750	412.771875
	412.778125
412.7875	412.784375
	412.790625
412.8000	412.796875
	412.803125
412.8125	412.809375
	412.815625
412.8250	412.821875
	412.828125
412.8375	412.834375
	412.840625
412.8500	412.846875
	412.853125
412.8625	412.859375
	412.865625
412.8750	412.871875
	412.878125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
412.8875	412.884375
	412.890625
412.9000	412.896875
	412.903125
412.9125	412.909375
	412.915625
412.9250	412.921875
	412.928125
412.9375	412.934375
	412.940625
412.9500	412.946875
	412.953125
412.9625	412.959375
	412.965625
412.9750	412.971875
	412.978125
412.9875	412.984375
	412.990625
413.0000	412.996875
	413.003125
413.0125	413.009375
	413.015625
413.0250	413.021875
	413.028125
413.0375	413.034375
	413.040625
413.0500	413.046875
	413.053125
413.0625	413.059375
	413.065625
413.0750	413.071875
	413.078125
413.0875	413.084375
	413.090625
413.1000	413.096875
	413.103125
413.1125	413.109375
	413.115625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
413.1250	413.121875
	413.128125
413.1375	413.134375
	413.140625
413.1500	413.146875
	413.153125
413.1625	413.159375
	413.165625
413.1750	413.171875
	413.178125
413.1875	413.184375
	413.190625
413.2000	413.196875
	413.203125
413.2125	413.209375
	413.215625
413.2250	413.221875
	413.228125
413.2375	413.234375
	413.240625
413.2500	413.246875
	413.253125
413.2625	413.259375
	413.265625
413.2750	413.271875
	413.278125
413.2875	413.284375
	413.290625
413.3000	413.296875
	413.303125
413.3125	413.309375
	413.315625
413.3250	413.321875
	413.328125
413.3375	413.334375
	413.340625
413.3500	413.346875
	413.353125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
413.3625	413.359375
	413.365625
413.3750	413.371875
	413.378125
413.3875	413.384375
	413.390625
413.4000	413.396875
	413.403125
413.4125	413.409375
	413.415625
413.4250	413.421875
	413.428125
413.4375	413.434375
	413.440625
413.4500	413.446875
	413.453125
413.4625	413.459375
	413.465625
413.4750	413.471875
	413.478125
413.4875	413.484375
	413.490625
413.5000	413.496875
	413.503125
413.5125	413.509375
	413.515625
413.5250	413.521875
	413.528125
413.5375	413.534375
	413.540625
413.5500	413.546875
	413.553125
413.5625	413.559375
	413.565625
413.5750	413.571875
	413.578125
413.5875	413.584375
	413.590625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
413.6000	413.596875
	413.603125
413.6125	413.609375
	413.615625
413.6250	413.621875
	413.628125
413.6375	413.634375
	413.640625
413.6500	413.646875
	413.653125
413.6625	413.659375
	413.665625
413.6750	413.671875
	413.678125
413.6875	413.684375
	413.690625
413.7000	413.696875
	413.703125
413.7125	413.709375
	413.715625
413.7250	413.721875
	413.728125
413.7375	413.734375
	413.740625
413.7500	413.746875
	413.753125
413.7625	413.759375
	413.765625
413.7750	413.771875
	413.778125
413.7875	413.784375
	413.790625
413.8000	413.796875
	413.803125
413.8125	413.809375
	413.815625
413.8250	413.821875
	413.828125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
413.8375	413.834375
	413.840625
413.8500	413.846875
	413.853125
413.8625	413.859375
	413.865625
413.8750	413.871875
	413.878125
413.8875	413.884375
	413.890625
413.9000	413.896875
	413.903125
413.9125	413.909375
	413.915625
413.9250	413.921875
	413.928125
413.9375	413.934375
	413.940625
413.9500	413.946875
	413.953125
413.9625	413.959375
	413.965625
413.9750	413.971875
	413.978125
413.9875	413.984375
	413.990625
414.0000	413.996875
	414.003125
414.0125	414.009375
	414.015625
414.0250	414.021875
	414.028125
414.0375	414.034375
	414.040625
414.0500	414.046875
	414.053125
414.0625	414.059375
	414.065625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
414.0750	414.071875
	414.078125
414.0875	414.084375
	414.090625
414.1000	414.096875
	414.103125
414.1125	414.109375
	414.115625
414.1250	414.121875
	414.128125
414.1375	414.134375
	414.140625
414.1500	414.146875
	414.153125
414.1625	414.159375
	414.165625
414.1750	414.171875
	414.178125
414.1875	414.184375
	414.190625
414.2000	414.196875
	414.203125
414.2125	414.209375
	414.215625
414.2250	414.221875
	414.228125
414.2375	414.234375
	414.240625
414.2500	414.246875
	414.253125
414.2625	414.259375
	414.265625
414.2750	414.271875
	414.278125
414.2875	414.284375
	414.290625
414.3000	414.296875
	414.303125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
414.3125	414.309375
	414.315625
414.3250	414.321875
	414.328125
414.3375	414.334375
	414.340625
414.3500	414.346875
	414.353125
414.3625	414.359375
	414.365625
414.3750	414.371875
	414.378125
414.3875	414.384375
	414.390625
414.4000	414.396875
	414.403125
414.4125	414.409375
	414.415625
414.4250	414.421875
	414.428125
414.4375	414.434375
	414.440625
414.4500	414.446875
	414.453125
414.4625	414.459375
	414.465625
414.4750	414.471875
	414.478125
414.4875	414.484375
	414.490625
414.5000	414.496875
	414.503125
414.5125	414.509375
	414.515625
414.5250	414.521875
	414.528125
414.5375	414.534375
	414.540625



TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
414.5500	414.546875
	414.553125
414.5625	414.559375
	414.565625
414.5750	414.571875
	414.578125
414.5875	414.584375
	414.590625
414.6000	414.596875
	414.603125
414.6125	414.609375
	414.615625
414.6250	414.621875
	414.628125
414.6375	414.634375
	414.640625
414.6500	414.646875
	414.653125
414.6625	414.659375
	414.665625
414.6750	414.671875
	414.678125
414.6875	414.684375
	414.690625
414.7000	414.696875
	414.703125
414.7125	414.709375
	414.715625
414.7250	414.721875
	414.728125
414.7375	414.734375
	414.740625
414.7500	414.746875
	414.753125
414.7625	414.759375
	414.765625
414.7750	414.771875
	414.778125

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
414.7875	414.784375
	414.790625
414.8000	414.796875
	414.803125
414.8125	414.809375
	414.815625
414.8250	414.821875
	414.828125
414.8375	414.834375
	414.840625
414.8500	414.846875
	414.853125
414.8625	414.859375
	414.865625
414.8750	414.871875
	414.878125
414.8875	414.884375
	414.890625
414.9000	414.896875
	414.903125
414.9125	414.909375
	414.915625
414.9250	414.921875
	414.928125
414.9375	414.934375
	414.940625
414.9500	414.946875
	414.953125
414.9625	414.959375
	414.965625
414.9750	414.971875
	414.978125
414.9875	414.984375
	414.990625
415.0000	414.996875
	415.003125
415.0125	415.009375
	415.015625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
415.0250	415.021875
	415.028125
415.0375	415.034375
	415.040625
415.0500	415.046875
	415.053125
415.0625	415.059375
	415.065625

TABLE 2: Single Channel	
Center Frequency 12.5kHz	Center Frequency 6.25 kHz
415.0750	415.071875
	415.078125
415.0875	415.084375
	415.090625
415.1000	415.096875
	415.103125

#### 4.3.10 Reserved

#### 4.3.11 Plan for Bio-Medical Telemetry and Medical Radiocommunication

##### BIO-MEDICAL TELEMETRY ONLY

38-41 MHz (see Annex K)

174-216 MHz (see Annex K)

460.650-460.875 MHz (see US209 in Section 4.1.3)

465.650-465.875 MHz (see US209 in Section 4.1.3)

##### MEDICAL RADIOCOMMUNICATION

The following frequencies may be authorized for the purpose of conducting radio operations for the delivery or rendition of medical services to individuals, subject to the indicated limitations.

Frequency (MHz)	Class of Station(s)	Limitation
150.775	Base and Mobile	1
150.790	Base and Mobile	1
152.0075	Base	2
163.250	Base	2
462.950	Base and Mobile	3,5
462.975	Base and Mobile	3,5
463.000	Base and Mobile	3,4,6,7
463.025	Base and Mobile	3,4,6,7
463.050	Base and Mobile	3,4,6,7
463.075	Base and Mobile	3,4,7,8
463.100	Base and Mobile	3,4,7,8
463.125	Base and Mobile	3,4,7,8
463.150	Base and Mobile	3,4,7,8
463.175	Base and Mobile	3,4,7,8
467.950	Mobile Only	3,5,9
467.975	Mobile Only	3,5,9

Frequency (MHz)	Class of Station(s)	Limitation
468.000	Mobile Only	3,4,6,7,9
468.025	Mobile Only	3,4,6,7,9
468.050	Mobile Only	3,4,6,7,9
468.075	Mobile Only	3,4,6,7,9
468.100	Mobile Only	3,4,6,7,9
468.125	Mobile Only	3,4,6,7,9
468.150	Mobile Only	3,4,6,7,9
468.175	Mobile Only	3,4,6,7,9

1. This frequency may be authorized for base (FB or FC), mobile (ML or MS), mobile repeater (MLR), and for fixed (FX) operations to access a repeater which retransmits on a different frequency. This frequency shall be authorized for both federal and non-federal use with a maximum Effective Radiated Power (ERP) of 100 watts. Airborne operations on this frequency are prohibited. The fixed station classes included in this limitation are in addition to those mentioned in US73 (A).

2. This frequency may be authorized only for one-way paging communications to mobile receivers. Transmissions for the purpose of activating or controlling remote objects on this frequency will not be authorized.

3. For two-frequency systems, separation between base and mobile transmit frequencies is 5 MHz.

4. For applications for new radio systems received after August 15, 1974, the eight frequency pairs listed below will be assigned in a block for shared operations subject to the following:

a. For uniformity in usage, these frequency pairs may be referred to by channel name, as follows:

Base and Mobile MHz	Mobile Only MHz	Channel Name
463.000	468.000	MED-ONE
463.025	468.025	MED-TWO
463.050	468.050	MED-THREE
463.075	468.075	MED-FOUR
463.100	468.100	MED-FIVE
463.125	468.125	MED-SIX
463.150	468.150	MED-SEVEN
463.175	468.175	MED-EIGHT

b. Except as provided in subparagraphs e. and f. of this paragraph, mobile or portable stations must employ equipment which is both wired and equipped to transmit/receive, respectively, on each of these eight frequency pairs.

c. Except as provided in subparagraph f. of this paragraph, base and fixed stations<sup>2</sup> must employ equipment which is both wired and equipped to transmit/receive, respectively, on at least four (three, if bio-medical telemetry operation is not employed in the system) of these eight frequency pairs.

d. Multi-channel equipment requirements for use of these frequency pairs are intended to afford capability for alternating use of the individual frequencies, and ability to conduct simultaneous operations is not required. These requirements may be met in a single equipment unit or in any combination of equipment units suitable to the applicant's operations.

e. Portable (hand-held) units operated with a maximum output power of 2.5 watts are exempted from the multi-channel equipment requirements specified in subparagraph c. of this paragraph.

f. Stations located in the Canadian coordination zone (see Section 3.4), will be required to meet multi-channel equipment requirements only for those frequencies up to the number specified in subparagraphs b.

<sup>2</sup> As indicated in Limitation 9, Section 4.3.11, transmissions by fixed stations are limited to the control of base station repeaters.

and c. of this paragraph which have been assigned to the licensee after coordination with Canada in accordance with the applicable US-Canada agreement.

5. This frequency may be authorized for the dispatch of medical-care vehicles and personnel for the rendition or delivery of medical services. Central-dispatch operations serving multisystem requirements in an area-wide medical radio communications plan may be authorized and may include the designation of this frequency for intra-system and inter-system mutual assistance purposes.

6. This frequency may be authorized on a primary basis for operations in bio-medical telemetry systems. F1D, F2D, and F3E emissions may be authorized. On a secondary basis, subject to noninterference to bio-medical telemetry systems, this frequency may be authorized for the transmission of messages related to the efficient administration of organizations and facilities engaged in medical services operations.

7. The continuous carrier mode of operation may be authorized for use of telemetry emission on this frequency.

8. This frequency may be authorized on a primary basis for communications, between medical facilities, vehicles, and personnel, related to medical supervision and instruction for treatment and transport of patients in the rendition or delivery of medical services. F2D and F3E emissions may be authorized. On a secondary basis, subject to noninterference to the foregoing types of operations, this frequency may be authorized for the transmission of messages related to the efficient administration of organizations and facilities engaged in medical services operations and for bio-medical telemetry transmissions, including the use of F1D emission.

9. This frequency may be assigned to a fixed station for the control of a base station repeater (FBR) if it is also assigned to the associated mobile station. Fixed stations operating on this frequency shall comply with the following requirements if they are located within 120 kilometers of the center of urbanized areas of 200,000 or more population.

a. If the station is used to control one or more base station repeaters located within 45 degrees of azimuth, a directional antenna having a front-to-back ratio of at least 15 dB shall be used at the fixed station. For other situations, where a directional antenna cannot be used, a cardioid, bi-directional or omnidirectional antenna may be employed. In each case, the antenna used must, consistent with reasonable design, produce a radiation pattern that provides only the coverage necessary to permit satisfactory control of each base station repeater and limit radiation in other directions to the extent feasible.

b. The strength of the signal of a fixed station, controlling a single base station repeater, may not exceed by more than 6 dB, at the antenna terminal of the base station repeater receiver, the signal strength produced there by a unit of the associated mobile station. When the station controls more than one base station repeater, the 6 dB control-to-mobile signal difference need be verified at only one of the base station repeater sites. The measurement of the signal strength of the mobile unit must be made when such unit is transmitting from the fixed station location or, if that is not practical, from a location within 400 meters of the fixed station site.

c. Each application for a fixed station to be authorized under the provisions of this paragraph shall be accompanied by a statement certifying that the output power of the proposed station transmitter will be adjusted to comply with the foregoing signal level limitation. Records of the measurements used to determine the signal ratio shall be kept with the station records and shall be made available for inspection upon request.

d. Urbanized areas of 200,000 or more population are defined in the U.S. Census Population, 1960, Vol. 1, Table 23, Page 50. The centers of urbanized areas are determined from the Appendix, page 226, of the U.S. Commerce publication "Air Line Distance Between Cities in the United States."

#### **4.3.12 Channeling Plan for Assignments in the Fixed Service in the 14500.0 to 14714.5 and 15136.5 to 15350.0 MHz**

1. The following channeling plan became effective on January 1, 1982, for all assignments in the Fixed Service.

2. Existing assignments as of January 1, 1982 in the Fixed Service which are in the bands 14500.0 to

14714.5 MHz and 15136.5 to 15350.0 MHz that are not in compliance with the channeling plan may be retained until January 1, 1997. However, if existing equipment is replaced prior to January 1, 1997, assignments for the replaced equipment must be in accordance with the channeling plan.

3. This channeling plan is only applicable to assignments in the Fixed Service in the bands 14500.0 to 14714.5 and 15136.5 to 15350.0 MHz. The assigned frequency shall be chosen such that the frequency “2 of its necessary bandwidth shall not extend beyond the upper or lower limits of bands indicated herein. A general breakdown of these bands is:

a. For emission bandwidths equal to or greater than 3.5 MHz:

14500.0 to 14710.0 MHz

15140.0 to 15350.0 MHz

b. For emission bandwidths less than 3.5 MHz:

14710.0 to 14714.5 MHz

15136.5 to 15140.0 MHz

4. Criteria for assignments in the Fixed Service with emission bandwidths equal to or greater than 3.5 MHz:

a. The assigned frequency must center on one of the frequencies given in Table 1.

b. Multiple contiguous channels are to be used for emission bandwidths of 3.5 MHz or greater.

c. In order to promote uniformity and to establish a natural guard band, it is strongly urged that frequencies be selected in pairs from the bands 14500.0 to 14710.0 and 15140.0 to 15350.0 on an equal basis.

5. Criteria for assignments in the Fixed Service with emission bandwidth of less than 3.5 MHz:

a. Assignments in the Fixed Service with emission bandwidths of less than 3.5 MHz are restricted to the bands:

14710.0 to 14714.5 MHz

and

15136.5 to 15140.0 MHz

b. Narrowband assignments, those with less than 3.5 MHz of necessary bandwidth, shall not be made in the bands 14500.0 to 14710.0 and 15140.0 to 15350.0 MHz.

**Table 1: Center Frequencies (MHz) of 2.5 MHz Channels in the Bands 14500.0-14714.5 MHz and 15136.5-15350.0 MHz**

<b>Table 1: Center Frequencies (MHz) of 2.5 MHz Channels in the Bands 14500.0-14714.5 MHz and 15136.5-15350.0 MHz</b>	
<b>14500.0-14714.5 MHz</b>	<b>15136.5-15350.0 MHz</b>
*14501.25	*15141.25
14503.75	15143.75
14506.25	15146.25
14508.75	15148.75
14511.25	15151.25
14513.75	15153.75
14516.25	15156.25
14518.75	15158.75
14521.25	15161.25
14523.75	15163.75
14526.25	15166.25
14528.75	15168.75
14531.25	15171.25
14533.75	15173.75
14536.25	15176.25

<b>Table 1: Center Frequencies (MHz) of 2.5 MHz Channels in the Bands 14500.0-14714.5 MHz and 15136.5-15350.0 MHz</b>	
<b>14500.0-14714.5 MHz</b>	<b>15136.5-15350.0 MHz</b>
14538.75	15178.75
14541.25	15181.25
14543.75	15183.75
14546.25	15186.25
14548.75	15188.75
14551.25	15191.25
14553.75	15193.75
14556.25	15196.25
14558.75	15198.75
14561.25	15201.25
14563.75	15203.75
14566.25	15206.25
14568.75	15208.75
14571.25	15211.25
14573.75	15213.75

<b>Table 1: Center Frequencies (MHz) of 2.5 MHz Channels in the Bands 14500.0-14714.5 MHz and 15136.5-15350.0 MHz</b>	
<b>14500.0-14714.5 MHz</b>	<b>15136.5-15350.0 MHz</b>
14576.25	15216.25
14578.75	15218.75
14581.25	15221.25
14583.75	15223.75
14586.25	15226.25
14588.75	15228.75
14591.25	15231.25
14593.75	15233.75
14596.25	15236.25
14598.75	15238.75
14601.25	15241.25
14603.75	15243.75
14606.25	15246.25
14608.75	15248.75
14611.25	15251.25
14613.75	15253.75
14616.25	15256.25
14618.75	15258.75
14621.25	15261.25
14623.75	15263.75
14626.25	15266.25
14628.75	15268.75
14631.25	15271.25
14633.75	15273.75
14636.25	15276.25
14638.75	15278.75
14641.25	15281.25
14643.75	15283.75
14646.25	15286.25

<b>Table 1: Center Frequencies (MHz) of 2.5 MHz Channels in the Bands 14500.0-14714.5 MHz and 15136.5-15350.0 MHz</b>	
<b>14500.0-14714.5 MHz</b>	<b>15136.5-15350.0 MHz</b>
14648.75	15288.75
14651.25	15291.25
14653.75	15293.75
14656.25	15296.25
14658.75	15298.75
14661.25	15301.25
14663.75	15303.75
14666.25	15306.25
14668.75	15308.75
14671.25	15311.25
14673.75	15313.75
14676.25	15316.25
14678.75	15318.75
14681.25	15321.25
14683.75	15323.75
14686.25	15326.25
14688.75	15328.75
14691.25	15331.25
14693.75	15333.75
14696.25	15336.25
14698.75	15338.75
14701.25	15341.25
14703.75	15343.75
14706.25	15346.25
*14708.75	*15348.75
* These channels cannot be used for bandwidths greater than 2.5 MHz. Total number of channels available--168.	

#### 4.3.13 Channeling Plan for Assignments in the Maritime Mobile Service

For digital maritime mobile systems operating before 1 January 2017, Appendix 17, Annex 2 of the ITU Radio Regulations may be used in accordance with footnote w. After this date, all frequency assignments must conform to Appendix 17, with priority for maritime mobile data transmission systems. Channeling Plan for Assignments in the Fixed Service in the Bands 932.4-935 MHz and 941.4-944 MHz

#### 4.3.14 Channeling Plan for Assignments in the Fixed Service in the Bands 932.4-935 MHz and 941.4-944 MHz

This plan is a guide for identifying the center frequencies of those paired frequencies that normally are used for assignments with a necessary bandwidth that can be accommodated within 12.5, 25, 50, 100 and 200 kHz. Transportable Operations are not permitted in the point-to-point bands 932.5-935.0 and 941.5-944.0 MHz. To permit flexibility, applicants for either point-to-point or point-to-multipoint channels will be permitted to combine channels upon a showing that there is a need and sufficient frequencies are available to permit this. Applicants may split channels if they choose to do so. The frequencies listed in this

plan are shared with non-federal users, and applications for assignment from federal users are subject to coordination with non-federal users prior to NTIA approval.

## CONDITIONS AND LIMITATIONS

1. Point-to-Multipoint Assignments: Table 1 contains a list of five pairs of frequencies that are designated for use only in fixed point-to-multipoint assignments operating with a necessary bandwidth of 12.5 kHz or less.

a. For paired frequency operations the 941.4-941.5 MHz frequencies will be used to transmit to the multipoint receiving stations, and the 932.4-932.5 MHz frequencies will be used for reverse link communications.

b. Unpaired, single frequency, one-way point-to-multipoint operations are permitted, using either of the paired frequencies. However, when the multipoint receiving stations are located less than 48 kilometers (30 miles) from the transmitting station, frequencies from the 932-932.5 MHz band must be used.

c. Point-to-point use of the 932.4-932.5 MHz frequencies will be permitted but only when the transmission is relayed by a station transmitting in the 941.4-941.5 MHz band.

d. Frequencies will be used so as to facilitate communications on an interference-free basis in each operational/service area. In order to facilitate maximum reuse of frequencies, stations separated by 113 kilometers (70 miles) or more, and operating on the same frequency (co-channel), will be considered as interference free (see also Section 8.2.16). However, at distances of less than 113 km, reuse of a frequency (co-channel) will be permitted only upon providing evidence that the operation will not cause harmful interference to existing users.

e. Equivalent power and antenna-height restrictions:

Antenna Height in Meters	Maximum Effective Radiated Power	
	In Watts	In dBm
152.5 and below	1,000	60
Above 152.5 up to 182	630	58
Above 182 up to 213	500	57
Above 213 up to 244	400	56
Above 244 up to 274	315	55
Above 274 up to 305	250	54
Above 305	200	53

2. Point-to-Point Assignments: Table 2 contains a list of thirty pairs of frequencies that are designated for two-way use in fixed point-to-point operations with a necessary bandwidth of 200 kHz or less. Frequencies shall be selected in pairs. However, unpaired frequency use, or single frequency one-way use, will be permitted, but only upon showing that spectrum is not available in other bands and that paired use will not be adversely affected.

## EXCEPTIONS

Exceptions to the above conditions and limitations will be considered by the FAS on a case-by-case basis.

**Table 1: Paired Frequencies for Point-to-Multipoint Assignments (12.5 kHz Bandwidth)**

<b>Table 1: Paired Frequencies for Point-to-Multipoint Assignments (12.5 kHz Bandwidth)</b>	
<b>MHz</b>	<b>MHz</b>
932.44375	941.44375
932.45625	941.45625
932.46875	941.46875
932.48125	941.48125
932.49375	941.49375

**Table 2: Paired Frequencies for Point-to-Point Assignments**

<b>Table 2: Paired Frequencies for Point-to-Point Assignments</b>							
<b>25 kHz Bandwidth Pairs</b>		<b>50 kHz Bandwidth Pairs</b>		<b>100 kHz Bandwidth Pairs</b>		<b>200 kHz Bandwidth Pairs</b>	
<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>
932.5125	941.5125	932.7000	941.7000	932.8250	941.8250	933.1750	942.1750
932.5375	941.5375	932.7500	941.7500	932.9250	941.9250	933.3750	942.3750
932.5625	941.5625	934.8000	943.8000	933.0250	942.0250	933.5750	942.5750
932.5875	941.5875			934.5250	943.5250	933.7750	942.7750
932.6125	941.6125			934.6250	943.6250	933.9750	942.9750
932.6375	941.6375			934.7250	943.7250	934.1750	943.1750
932.6625	941.6625					934.3750	943.3750
934.8375	943.8375						
934.8625	943.8625						
934.8875	943.8875						
934.9125	943.9125						
934.9375	943.9375						
934.9625	943.9625						
934.9875	943.9875						

#### 4.3.15 Channeling Plan for Land Mobile Assignments in the Band 220-222 MHz

1. The following channeling plan is composed of 200 frequency pairs for shared federal/non-federal land-mobile operations with necessary bandwidths less than or equal to 4 kHz. Of these 200 channel pairs, 60 pairs are for nationwide use and 140 pairs are for shared local use. Of the 60 nationwide channel pairs, 10 are for exclusive federal use and 50 are for exclusive non-federal use. Of the 140 shared local-use channel pairs, 100 are available for trunked operations or other operations of equivalent or greater efficiency, 20 are set aside for data only operations until March 31, 2000, 10 are available for public safety/mutual aid, and the remaining 10 channel pairs have no restrictions on use.

2. The following table indicates the channel designations of frequencies (channel number, base station frequency and function) available for assignment under the following conditions:

- a. Frequencies shall be assigned in pairs, with base station frequencies taken from the 220-221 MHz



band, corresponding mobile frequencies being 1 MHz higher, taken from the 221-222 MHz band.

b. Only the lower half of the frequency pairs is listed in the table.

**Table of 220-222 MHz Channel Designations**  
(Channel Number, Base Frequency in MHz and Function)

<b>Trunked Systems</b> (See next paragraph for Trunked Channel Groups)			
<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
1	220.0025	11	.0525
2	.0075	12	.0575
3	.0125	13	.0625
4	.0175	14	.0675
5	.0225	15	.0725
6	.0275	16	.0775
7	.0325	17	.0825
8	.0375	18	.0875
9	.0425	19	.0925
10	.0475	20	.0975

<b>Non-Federal Nationwide System</b>			
<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
21	220.1025	26	220.1275
22	.1075	27	.1325
23	.1125	28	.1375
24	.1175	29	.1425
25	.1225	30	.1475

<b>Trunked Systems</b> (See next paragraph for Trunked Channel Groups)			
<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
31	220.1525	41	220.2025
32	.1575	42	.2075
33	.1625	43	.2125
34	.1675	44	.2175
35	.1725	45	.2225
36	.1775	46	.2275
37	.1825	47	.2325
38	.1875	48	.2375
39	.1925	49	.2425
40	.1975	50	.2475

<b>Non-Federal Nationwide Systems</b>			
<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
51	220.2525	56	.2775
52	.2575	57	.2825
53	.2625	58	.2875
54	.2675	59	.2925
55	.2725	60	.2975

Trunked Systems			
Ch. #	Base Frequency (in MHz)	Ch. #	Base Frequency (in MHz)
61	220.3025	71	.3525
62	.3075	72	.3575
63	.3125	75	.3625
64	.3175	74	.3675
65	.3225	75	.3725
66	.3275	76	.3775
67	.3325	77	.3825
68	.3375	78	.3875
69	.3425	79	.3925
70	.3475	80	.3975

Non-Federal Nationwide Systems			
Ch. #	Base Frequency (in MHz)	Ch. #	Base Frequency (in MHz)
81	220.4025	86	.4275
82	.4075	87	.4325
83	.4125	88	.4375
84	.4175	89	.4425
85	.4225	90	.4475

Trunked Systems			
Ch. #	Base Frequency (in MHz)	Ch. #	Base Frequency (in MHz)
91	220.4525	101	.5025
92	.4575	102	.5075
93	.4625	103	.5125
94	.4675	104	.5175
95	.4725	105	.5225
96	.4775	106	.5275
97	.4825	107	.5325
98	.4875	108	.5375
99	.4925	109	.5425
100	.4975	110	.5475

Federal Nationwide Systems			
Ch. #	Base Frequency (in MHz)	Ch. #	Base Frequency (in MHz)
111	220.5525	116	220.5775
112	.5575	117	.5825
113	.5625	118	.5875
114	.5675	119	.5925
115	.5725	120	.5975
Trunked Systems			
Ch. #	Base Frequency (in MHz)	Ch. #	Base Frequency (in MHz)
121	220.6025	131	220.6525
122	.6075	132	.6575
123	.6125	133	.6625
124	.6175	134	.6675
125	.6225	135	.6725

126	.6275	136	.6775
127	.6325	137	.6825
128	.6375	138	.6875
129	.6425	139	.6925
130	.6475	140	.6975

**Non-Federal Nationwide Systems**

<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
141	220.7025	151	.7525
142	.7075	152	.7575
143	.7125	153	.7625
144	.7175	154	.7675
145	.7225	155	.7725
146	.7275	156	.7775
147	.7325	157	.7825
148	.7375	158	.7875
149	.7425	159	.7925
150	.7475	160	.7975

**Public Safety/Mutual Air Operations**

<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
161	220.8025	166	220.8275
162	.8075	167	.8325
163	.8125	168	.8375
164	.8175	169	.8425
165	.8225	170	.8475

**Available for any use**

<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
171	220.8525	176	220.8775
172	.8575	177	.8825
173	.8625	178	.8875
174	.8675	179	.8925
175	.8725	180	.8975

**Data Operations (See Note \*)**

<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>	<b>Ch. #</b>	<b>Base Frequency (in MHz)</b>
181	220.9025	191	220.9525
182	.9075	192	.9575
183	.9125	193	.9625
184	.9175	194	.9675
185	.9225	195	.9725
186	.9275	196	.9775
187	.9325	197	.9825
188	.9375	198	.9875
189	.9425	199	.9925
190	.9475	200	.9975

Note: Channels 181-185 and 196-200 are indefinitely reserved until further FCC action and are not currently available for assignment or use.

## Trunked Channel Groups

The channel groups listed in the following table are available to both federal and non-federal applicants for trunked operations.

**Table - Trunked Channel Groups**

<b>Group #</b>	<b>Channel #</b>	<b>Group #</b>	<b>Channel #</b>
1	1-31-61-91-121	11	11-41-71-101-131
2	2-32-62-92-122	12	12-42-72-102-132
3	3-33-63-93-123	14	14-44-74-104-134
4	4-34-64-94-124	15	15-45-75-105-135
5	5-35-65-95-125	16	16-46-76-106-136
6	6-36-66-96-126	11	11-41-71-101-131
7	7-37-67-97-127	17	17-47-77-107-137
8	8-38-68-98-128	18	18-48-78-108-138
9	9-39-69-99-129	19	19-49-79-109-139
10	10-40-70-100-130	20	20-50-80-110-140

### 4.3.16 Plans for Federal Interoperability Channels for Interagency Law Enforcement and Incident Response Operations in the Bands 162-174 MHz and 406.1-420 MHz

#### CONDITIONS FOR USE

1. The plans shown in Tables 1 and 2 show frequencies available for assignment to all federal agencies to satisfy law enforcement, public safety, emergency response, and disaster response interoperability requirements. These frequencies will be referred to hereinafter as “Federal Interoperability Channels”.

2. The Federal Interoperability Channels are available for use among federal agencies and between federal agencies and non-federal entities with which federal agencies have a requirement to operate.

3. The channels are available to federal agencies on a shared basis and will not be authorized for the exclusive use of any one federal agency.

4. The channels are available to non-federal entities to enable joint federal/non-federal operations for law enforcement, public safety, emergency response and disaster response, subject to the condition that harmful interference will not be caused to federal stations.

5. Non-federal use will be coordinated with the FCC through the Statewide Interoperability Coordinator (SWIC) or a state appointed official. The FCC will grant authority to program and use the Federal Interoperability Channels through a signed agreement between the SWIC or state appointed official and a federal user with a valid GMF assignment.

6. These channels are restricted to mobile (including portable) interoperability communications and are not authorized for routine or administrative uses.

7. These channels are authorized to operate mobile (including portable) to perform testing, training and exercises of interoperable communications, subject to the existing geographic restrictions maintained by NTIA.

8. Extended operations and congestion may lead to frequency conflicts. Coordination with NTIA is required so that interference can be avoided.

9. Only narrowband emissions are authorized on the Federal Interoperability Channels.

10. Federal agencies having a law enforcement, public safety, emergency response or disaster response requirement will ensure that their agency is added to the (\*JNT) circuit remarks field in

the Government Master File (GMF).

11. All federal law enforcement, public safety, emergency response, and disaster response agencies are required to have the Federal Interoperability Channels programmed into one or more zones/banks/channel groups of their mobile (including portable) radios.

12. Exceptions to the above conditions of use will be considered by the Interdepartment Radio Advisory Committee (IRAC)/Frequency Assignment Subcommittee (FAS) on a case-by-case basis.

## LAW ENFORCEMENT PLANS

1. Frequencies 167.0875 MHz and 414.0375 MHz are designated as National Calling Channels for initial contact and will be identified in the radio as indicated in Table 1.

2. Initial contact communications will be established using analog FM emission (11KF3E).

3. The interoperability channels will be identified in mobile and portable radios as follows with Continuous Tone Controlled Squelch Systems (CTCSS) frequency 167.9 Hz and/or Network Access Code (NAC) \$68F:

**Table 1 Law Enforcement Channeling Plans**

LE VHF PLAN			LE UHF PLAN		
Identifier	Mobile Transmit (MHz)	Mobile Receive (MHz)	Identifier	Mobile Transmit (MHz)	Mobile Receive (MHz)
LEA	167.0875 (Simplex)	167.0875	LEB	414.0375 (Simplex)	414.0375
LE1	162.0875	167.0875	LE10	418.9875	409.9875
LE2	162.2625	167.2500	LE11	419.1875	410.1875
LE3	162.8375	167.7500	LE12	419.6125	410.6125
LE4	163.2875	168.1125	LE13	414.0625 (Simplex)	414.0625
LE5	163.4250	168.4625	LE14	414.3125 (Simplex)	414.3125
LE6	167.2500 (Simplex)	167.2500	LE15	414.3375 (Simplex)	414.3375
LE7	167.7500 (Simplex)	167.7500	LE16	409.9875 (Simplex)	409.9875
LE8	168.1125 (Simplex)	168.1125	LE17	410.1875 (Simplex)	410.1875
LE9	168.4625 (Simplex)	168.4625	LE18	410.6125 (Simplex)	410.6125

## INCIDENT RESPONSE PLANS

1. Frequencies 169.5375 MHz, paired with 164.7125 MHz, and 410.2375 MHz, paired with 419.2375 MHz, are designated as the calling channels for initial contact and will be identified in the radio as indicated in Table 2.

2. Initial contact will be established using analog FM emission (11KF3E).

3. To ensure access by stations from outside the normal area of operation, CTCSS will not be used on the calling channels.

4. The interoperability channels will be identified in mobile and portable radios as follows:

**Table 2 Incident Response Channeling Plans**

IR VHF PLAN				IR UHF PLAN			
Identifier	Mobile Transmit (MHz)	Mobile Receive (MHz)	CTCSS	Identifier	Mobile Transmit (MHz)	Mobile Receive (MHz)	CTCSS
NC 1 Calling	164.7125	169.5375	None	NC 2 Calling	419.2375	410.2375	None
IR1	165.2500	170.0125	As required	IR10	419.4375	410.4375	As required
IR2	165.9625	170.4125	As required	IR11	419.6375	410.6375	As required
IR3	166.5750	170.6875	As required	IR12	419.8375	410.8375	As required
IR4	167.3250	173.0375	As required	IR13	413.1875 (Simplex)	413.1875	As required
IR5	169.5375 (Simplex)	169.5375	As required	IR14	413.2125 (Simplex)	413.2125	As required
IR6	170.0125 (Simplex)	170.0125	As required	IR15	410.2375 (Simplex)	410.2375	As required
IR7	170.4125 (Simplex)	170.4125	As required	IR16	410.4375 (Simplex)	410.4375	As required
IR8	170.6875 (Simplex)	170.6875	As required	IR17	410.6375 (Simplex)	410.6375	As required
IR9	173.0375 (Simplex)	173.0375	As required	IR18	410.8375 (Simplex)	410.8375	As required

#### 4.3.17 Plan for JTIDS TDMA Waveform Systems

1. The Joint Tactical Information Distribution System/Multifunctional Information Distribution System (JTIDS/MIDS) Time Division Multiple Access (TDMA) Waveform is the designation for the tactical data link system used by the military services, which is critical to the “Command and Control” infrastructure of the Department of Defense (DOD). This waveform designation applies to the JTIDS family of terminals (Class 1, Class 2, Class 2M and Class 2H); MIDS Low Volume Terminal (LVT) variants (LVT-1, LVT-2, LVT-3/Fighter Data Link); and future approved systems incorporating the JTIDS/MIDS TDMA Waveform implementation. These TDMA systems provide the DOD with totally Integrated Communications, Navigation and Identification (ICNI) capabilities. The DOD refers to these terminals collectively as “Link 16”.

2. JTIDS/MIDS TDMA Waveform operation is authorized in the 960-1215 MHz band and in addition, the DOD and the Department of Transportation (DOT) have made agreements to assure spectrum access and to maintain mutual compatibility between Air Traffic Control (ATC) systems and JTIDS/MIDS TDMA Waveform systems within the United States and its possessions (US&P). The following paragraphs are consistent with DOD - DOT agreements:

a. Uncoordinated JTIDS/MIDS TDMA Waveform operations are authorized in the 960-1215 MHz band in accordance with the coordinations outlined in the authorizing NTIA spectrum certification documents.

b. The DOD shall incorporate engineering features in the JTIDS/MIDS TDMA Waveform equipment in accordance with the NTIA guidance and requirements for JTIDS/MIDS EMC features. The engineering features when implemented shall minimize the possibility for harmful interference between ATC and JTIDS/MIDS TDMA Waveform systems operating in the US&P.

c. The DOT will support US&P frequency assignments for JTIDS/MIDS TDMA Waveform operations, with the conditions identified in the authorizing NTIA spectrum certification documents and as set forth herein.

d. The DOD will ensure that by January 1, 2025, all fielded JTIDS/MIDS TDMA Waveform terminals are capable of remapping frequencies. MIDS LVT terminals will be retrofitted with the remapping

capability and recertified between January 1, 2012 and December 31, 2022. These retrofits will occur during any scheduled system updates/modifications, when the terminals are brought in for maintenance. If necessary, special procedures will be established to ensure that all retrofits are completed no later than January 1, 2025. Any JTIDS/MIDS TDMA Waveform terminal produced after July 1, 2007 other than the MIDS LVT terminals will be capable of remapping. The remapping implementation will be flexible, but there will not be a requirement to remap more than 14 carrier frequencies. The remapping capability will be utilized as necessary to prevent harmful interference with ATC systems that have been approved by a NTIA Stage 4 spectrum certification. Between January 1, 2020 and January 1, 2025, only JTIDS/MIDS TDMA Waveform terminals that are either (i) capable of remapping, or (ii) on the “remap non-compliant terminal list” (see 4.a) will be considered for frequency assignments.

e. The DOT will ensure that planned and future systems/equipment subject to its jurisdiction that are to be implemented using spectrum not subject to remapping will be designed to satisfy their minimum performance standards in their intended electromagnetic environments. This environment includes JTIDS/MIDS TDMA Waveform systems operating in conformance with the remapping requirement. This will ensure that such new or modified systems shall incorporate features so as to not constrain JTIDS/MIDS TDMA Waveform Terminals operations in accordance with the approved NTIA Spectrum Certification.

f. Coordination procedures for JTIDS/MIDS TDMA Waveform operations involving all 51 frequencies, operations exceeding approved NTIA spectrum certification conditions and operations involving non-US and new terminals shall be cooperatively developed by DOD and DOT.

3. The DOD is granted this one-time extension to January 1, 2025 due to budgeting issues and delayed technology development. Any Link 16 terminal not certified with frequency remapping capabilities, by the January 1, 2025 due date, will not transmit within the US&P on training sorties or training events.

Per agreements with coalition partner nations, this mandate will include terminals manufactured outside the United States that may be used within the US&P.

4. The DOD will utilize the Joint Capabilities Integration and Development System (JCIDS) as a means to govern and oversee the integration of frequency remapping terminals across the Services. In the event of further budgeting and technology issues, the DOD will make necessary budgetary adjustments to meet the 2025 mandate.

The DOD will compile and submit to IRAC a list of “remap non-compliant terminals” by January 1, 2020. Those terminals will be tracked and the DOD will report to the IRAC and FAA every 6 months or as needed with the current progress towards compliance with the 2025 mandate.

5. Some JTIDS/MIDS TDMA Waveform terminals are not capable of utilizing contention access while operating in Full EMC Protect mode. Since Full EMC Protect mode operation is a key feature to minimize the possibility for harmful interference between ATC NAVAIDS and JTIDS/MIDS TDMA Waveform systems operating in the US&P, those contention non-compliant terminals are only authorized on a limited, case-by-case basis. Except as noted in 5.a, after January 1, 2025, frequency assignments will only be considered for JTIDS/MIDS TDMA Waveform terminals operating in Full EMC Protect Mode.

On a limited, case-by-case basis, DOD will need to use Combat and Exercise mode for special events, such as network enable weapons testing and delivery and/or specific DOD training requirements. DOD and FAA will continue to address such requirements through the use of temporary frequency authorizations, which will include the dates and time periods of the events.

#### **4.3.18 4400-4940 MHz Channel Plan**

1. This section describes the 4400-4940 MHz Channel Plan for stations operating in the fixed service and provides guidance on its implementation. This channel plan will become effective on August 1, 2009 and all incumbent frequency assignments in the 4400-4940 MHz band and will be grandfathered until the equipment or frequency is changed.

2. Figure 1 provides an overview of the 4400-4940 MHz Channel Plan.

Figure 1: The 4400-4940 MHz Channel Plan

4400 - 4940 MHz CHANNEL PLAN																															
4.670 GHz → ← 4.670 GHz																															
4 GHz Channel Bandwidths	Lower Band															Upper Band															
	← 4.400 GHz															4.640 GHz →															
40.00 MHz (A)	A1		A2		A3		A4		A5		A6				A1'		A2'		A3'		A4'		A5'		A6'						
30.00 MHz (B)	B1	B2	B3	B4	B5	B6	B7	B8	B9		B10		B1'	B2'	B3'	B4'	B5'	B6'	B7'	B8'											
20.00 MHz (C)	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C1'	C2'	C3'	C4'	C5'	C6'	C7'	C8'	C9'	C10'	C11'	C12'				
10.00 MHz (D)	(D1-D4)		(20) 10 MHz (D5-D24)										25	26	27	28	29	30	(D1' -D4')		(20) 10 MHz (D5'-D24')										
5.00 MHz (E)	(8) 5 MHz		(40) 5 MHz* (E9-E48)										(12) 5.00 MHz (E49-E60)					(8) 5 MHz		(40) 5 MHz* (E9'-E48')											
2.50 MHz (F)	(16) 2.5 MHz		(80) 2.5 MHz* (F17-F96)										(24)2.50MHz (F97-F120)					(16) 2.5 MHz		(80) 2.5 MHz* (F17'-F96')											
1.25 MHz (G)	(32) 1.25MHz		(160) 1.25 MHz* (G33-G192)										(48)1.25MHz(G193-G240)					(32) 1.25MHz		(160) 1.25 MHz* (G33'-G192')											
													One-Way Applications																		

NOTE: Paired channels will be implemented for fixed service assignments using A1 with A1', A2 with A2', etc.



3. Applicable Guidance. In implementing the 4400-4940 MHz Channel Plan, the following guidance applies.

a. This channel plan only applies to fixed and/or transportable fixed assignments. For mobile or airborne assignments, this channel plan should be used to the extent possible.

b. Incumbent fixed and/or transportable fixed assignments will be grandfathered until the end of the life-cycle of the equipment<sup>3</sup> and all replacement equipment will utilize frequencies in accordance with this channel. Other assignments should use this channel plan to the extent possible.

c. Any request for changes or modifications to “grandfathered” fixed service and/or transportable fixed assignments, except for the frequency, will be governed by existing NTIA procedures. However, if the operating frequency is to be modified, the replacement frequency will be selected in accordance with this channel plan.

d. The First Priority Channels will be considered first before the other designated channels.

e. The Second Priority Channels will be considered if the First Priority Channels are not available.

f. The wide-band Third Priority Channels (i.e., A1/A1'; B1/B1'; B9 and B10; C13, C14, and C15) will be considered only if their respective First and Second Priority Channels are not available.

g. The narrow-band Third Priority Channels (i.e., E-, F-, and G-Channels) will be considered only if their respective First Priority Channels are not available. The following narrow-band channels: E9/E9', E10/E10'; F17/E17' through F20/F20'; G33/G33' through G40/G40' will be considered first before the other respective narrow-band channels.

h. Fixed and/or transportable fixed assignments, may use either channel of a paired-channel if the one-way link First Priority Channels are not available.<sup>4</sup> or if multiple one-way links assignments are required.

i. Fixed and/or transportable fixed assignments for which the emission bandwidth exceeds the bandwidth of a channel will use the next available wider channel in the channel plan. For example, an assignment with an emission bandwidth of 24 MHz will use a 30 MHz channel (*e.g., Channel B6 centered at 4565 MHz and see also Channel D17 in Table 4*).

j. Fixed and/or transportable fixed assignments for which the emission bandwidth exceeds 40 MHz may use concatenated channels<sup>5</sup> commensurate with the emission bandwidth. However, the center frequency of the concatenated channels should be one of the center frequencies listed in the channel plan. For example, an assignments with a emission bandwidth of 60 MHz would require two concatenated 30 MHz channels, such as channels B7 and B8 with the center frequency being 4610 MHz (*see Channel C11 in Table 3*).

4. The following tables list the center frequencies for narrowband, wideband and single or unpaired channels.

a. Tables 1 through 4 show the center frequencies of the wide-band paired channels (*i.e., Channels A-40 MHz, B-30 MHz, C-20 MHz, and D-10 MHz*) in the 4400-4940 MHz Channel Plan and their respective channel status.

## CENTER FREQUENCIES FOR THE WIDE-BAND PAIRED CHANNELS

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<sup>3</sup> Transportable fixed assignments, include assignments employing one-way link applications; such as video target scoring, air-to-ground video downlink, ground-to-ground video and/or voice transmissions, etc.

<sup>4</sup> Currently, land mobile radio assignments are not deployed in the 4400-4940 MHz band. In such time that land mobile radio assignments will be deployed in the band, the base stations will transmit at channels from the upper portion of the channel plan (*i.e., 4670-4940 MHz band segment*) and mobile units will transmit from the lower portion of the channel plan (*i.e., 4400-4670 MHz band segment*).

<sup>5</sup> The term “concatenated channels” means any two or more adjacent channels in the 4400-4940 MHz band joined together for the purpose of accommodating a assignment having an emission bandwidth that exceeds the widest channel bandwidth in the channel plan.

**Table 1: The Center Frequencies for the 40 MHz Wide-Band Paired Channels (A-Channels)**

Table 1		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>First Priority Channels</b>		
A2/A2' (4460/4760)	A3/A3' (4500/4800)	A4/A4' (4540/4840)
<b>Second Priority Channels</b>		
A5/A5' (4580/4880)	A6/A6' (4620/4920)	
<b>Third Priority Channels</b>		
A1/A1' (4420/4720)		

**Table 2: The Center Frequencies for the 30 MHz Wide-Band Paired Channels (B-Channels)**

Table 2		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>First Priority Channels</b>		
B6/ B6' (4565/4865)	B7/B7' (4595/4895)	B8/B8' (4625/4925)
<b>Second Priority Channels</b>		
B2/B2' (4445/4745)	B4/B4' (4505/4805)	B5/B5' (4535/4835)
B3/B3' (4475/4775)		
<b>Third Priority Channels</b>		
B1/B1' (4415/4715)		

**Table 3: The Center Frequencies for the 20 MHz Wide-Band Paired Channels (C-Channels)**

Table 3		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>First Priority Channels</b>		
C1/C1' (4410/4710)	C2/C2' (4430/4730)	
<b>Second Priority Channels</b>		
C3/C3' (4450/4750)	C7/C7' (4530/4830)	C10/C10' (4590/4890)
C4/C4' (4470/4770)	C8/C8' (4550/4850)	C11/C11' (4610/4910)
C5/C5' (4490/4790)	C9/C9' (4570/4870)	C12/C12' (4630/4930)
C6/C6' (4510/4810)		

**Table 4: The Center Frequencies for the 10 MHz Wide-Band Paired Channels (D-Channels)**

Table 4		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>First Priority Channels</b>		
D1/D1' (4405/4705)	D3/D3' (4425/4725)	D4/D4' (4435/4735)
D2/D2' (4415/4715)		
<b>Second Priority Channels</b>		

<b>Table 4</b>		
<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>
D5/D5' (4445/4745)	D12/D12' (4515/4815)	D19/D19' (4585/4885)
D6/D6' (4455/4755)	D13/D13' (4525/4825)	D20/D20' (4595/4895)
D7/D7' (4465/4765)	D14/D14' (4535/4835)	D21/D21' (4605/4905)
D8/D8' (4475/4775)	D15/D15' (4545/4845)	D22/D22' (4615/4915)
D9/D9' (4485/4785)	D16/D16' (4555/4855)	D23/D23' (4625/4925)
D10/D10' (4495/4795)	D17/D17' (4565/4865)	D24/D24' (4635/4935)
D11/D11' (4505/4805)	D18/D18' (4575/4875)	

b. Tables 5 through 7 show the center frequencies of the narrow-band paired channels (i.e., Channels E-5 MHz, F-2.5 MHz, and G-1.5 MHz) in the 4400-4940 MHz Channel Plan and their respective channel status.

## CENTER FREQUENCIES FOR THE NARROW-BAND PAIRED CHANNELS

**Table 5: The Center Frequencies for the 5 MHz Narrow-Band Paired Channels (E-Channels)<sup>6</sup>**

<b>Table 5</b>		
<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>
<b>First Priority Channels</b>		
E1/E1' (4402.5/4702.5)	E4/E4' (4417.5/4717.5)	E7/E7' (4432.5/4732.5)
E2/E2' (4407.5/4707.5)	E5/E5' (4422.5/4722.5)	E8/E8' (4437.5/4737.5)
E3/E3' (4412.5/4712.5)	E6/E6' (4427.5/4727.5)	
<b>Third Priority Channels</b>		
E9/E9' (4442.5/4742.5)	E23/E23' (4512.5/4812.5)	E37/E37' (4582.5/4882.5)
E10/E10' (4447.5/4747.5)	E24/E24' (4517.5/4817.5)	E38/E38' (4587.5/4887.5)
E11/E11' (4452.5/4752.5)	E25/E25' (4522.5/4822.5)	E39/E39' (4592.5/4892.5)
E12/E12' (4457.5/4757.5)	E26/E26' (4527.5/4827.5)	E40/E40' (4597.5/4897.5)
E13/E13' (4462.5/4762.5)	E27/E27' (4532.5/4832.5)	E41/E41' (4602.5/4902.5)
E14/E14' (4467.5/4767.5)	E28/E28' (4537.5/4837.5)	E42/E42' (4607.5/4907.5)
E15/E15' (4472.5/4772.5)	E29/E29' (4542.5/4842.5)	E43/E43' (4612.5/4912.5)
E16/E16' (4477.5/4777.5)	E30/E30' (4547.5/4847.5)	E44/E44' (4617.5/4917.5)
E17/E17' (4482.5/4782.5)	E31/E31' (4552.5/4852.5)	E45/E45' (4622.5/4922.5)
E18/E18' (4487.5/4787.5)	E32/E32' (4557.5/4857.5)	E46/E46' (4627.5/4927.5)
E19/E19' (4492.5/4792.5)	E33/E33' (4562.5/4862.5)	E47/E47' (4632.5/4932.5)
E20/E20' (4497.5/4797.5)	E34/E34' (4567.5/4867.5)	E48/E48' (4637.5/4937.5)
E21/E21' (4502.5/4802.5)	E35/E35' (4572.5/4872.5)	
E22/E22' (4507.5/4807.5)	E36/E36' (4577.5/4877.5)	

**Table 6: The Center Frequencies for the 2.5 MHz Narrow-Band Paired Channels (F-Channels)<sup>7</sup>**

<sup>6</sup>. There are no secondary channels for the E-Channels (5 MHz channels).

<sup>7</sup>. There are no secondary channels for the F-Channels (2.5 MHz channels).

Table 6		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>First Priority Channels</b>		
F1/F1' (4401.25/4701.25)	F7/F7' (4416.25/4716.25)	F12/F12' (4428.75/4728.75)
F2/F2' (4403.75/4703.75)	F8/F8' (4418.75/4718.25)	F13/F13' (4413.25/4731.25)
F3/F3' (4406.25/4706.25)	F9/F9' (4421.25/4721.25)	F14/F14' (4433.75/4733.75)
F4/F4' (4408.75/4708.25)	F10/F10' (4423.75/4723.25)	F15/F15' (4436.25/4736.25)
F5/E5' (4411.25/4711.25)	F11/F11' (4426.25/4726.25)	F16/F16' (4438.75/4738.75)
F6/F6' (4413.75/4713.25)		
<b>Third Priority Channels</b>		
F17/F17' (4441.25/4741.25)	F44/F44' (4508.75/4808.75)	F71/F71' (4576.25/4876.25)
F18/F18' (4443.75/4743.75)	F45/F45' (4511.25/4811.25)	F72/F72' (4578.75/4878.75)
F19/F19' (4446.25/4746.25)	F46/F46' (4513.75/4813.75)	F73/F73' (4581.25/4881.25)
F20/F20' (4448.75/4748.75)	F47/F47' (4516.25/4816.25)	F74/F74' (4583.75/4883.75)
F21/F21' (4451.25/4751.25)	F48/F48' (4518.75/4818.75)	F75/F75' (4586.25/4886.25)
F22/F22' (4453.75/4753.75)	F49/F49' (4521.25/4821.25)	F76/F76' (4588.75/4888.75)
F23/F23' (4456.25/4756.25)	F50/F50' (4523.75/4823.75)	F77/F77' (4591.25/4891.25)
F24/F24' (4458.75/4758.75)	F51/F51' (4526.25/4826.25)	F78/F78' (4593.75/4893.75)
F25/F25' (4461.25/4761.25)	F52/F52' (4528.75/4828.75)	F79/F79' (4596.25/4896.25)
F26/F26' (4463.75/4763.75)	F53/F53' (4531.25/4831.25)	F80/F80' (4598.75/4898.75)
F27/F27' (4466.25/4766.25)	F54/F54' (4533.75/4833.75)	F81/F81' (4601.25/4901.25)
F28/F28' (4468.75/4768.75)	F55/F55' (4536.25/4836.25)	F82/F82' (4603.75/4903.75)
F29/F29' (4571.25/4771.25)	F56/F56' (4538.75/4838.75)	F83/F83' (4606.25/4906.25)
F30/F30' (4473.75/4773.75)	F57/F57' (4541.25/4841.25)	F84/F84' (4608.75/4908.75)
F31/F31' (4476.25/4776.25)	F58/F58' (4543.75/4843.75)	F85/F85' (4611.75/4911.75)
F32/F32' (4478.75/4778.75)	F59/F59' (4546.25/4846.25)	F86/F86' (4613.25/4913.25)
F33/F33' (4481.25/4781.25)	F60/F60' (4548.75/4848.75)	F87/F87' (4616.25/4916.25)
F34/F34' (4483.75/4783.75)	F61/F61' (4551.25/4851.25)	F88/F88' (4618.75/4918.75)
F35/F35' (4486.25/4786.25)	F62/F62' (4553.75/4853.75)	F89/F89' (4621.25/4921.25)
F36/F36' (4488.75/4788.75)	F63/F63' (4556.25/4856.25)	F90/F90' (4623.75/4923.75)
F37/F37' (4491.25/4791.25)	F64/F64' (4558.75/4858.75)	F91/F91' (4626.25/4926.25)
F38/F38' (4493.75/4793.75)	F65/F65' (4561.25/4861.25)	F92/F92' (4628.75/4928.75)
F39/F39' (4496.25/4796.25)	F66/F66' (4563.75/4863.75)	F93/F93' (4631.25/4931.25)
F40/F40' (4498.75/4798.75)	F67/F67' (4566.25/4866.25)	F94/F94' (4633.75/4933.75)
F41/F41' (4501.25/4801.25)	F68/F68' (4568.75/4868.75)	F95/F95' (4636.25/4936.25)
F42/F42' (4503.75/4803.75)	F69/F69' (4571.25/4871.25)	F96/F96' (4638.75/4938.75)
F43/F43' (4506.25/4806.25)	F70/F70' (4573.75/4873.75)	

**Table 7: The Center Frequencies for the 1.25 MHz Narrow-Band Paired Channels (G-Channels)<sup>8</sup>**

Table 7		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>First Priority Channels</b>		
G1/G1' (4400.625/4700.625)	G12/G12' (4414.375/4714.375)	G23/G23' (4428.125/4728.125)
G2/G2' (4401.875/4701.875)	G13/G13' (4415.625/4715.625)	G24/G24' (4429.375/4729.375)
G3/G3' (4403.125/4703.125)	G14/G14' (4416.875/4716.875)	G25/G25' (4430.625/4730.625)

<sup>8</sup>. There are no secondary channels for the G-Channels (1.25 MHz channels).

Table 7		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
G4/G4' (4404.375/4704.325)	G15/G15' (4418.125/4718.125)	G26/G26' (4431.875/4731.875)
G5/G5' (4405.625/4705.625)	G16/G16' (4419.375/4719.375)	G27/G27' (4433.125/4733.125)
G6/G6' (4406.875/4706.825)	G17/G17' (4420.625/4720.625)	G28/G28' (4434.375/4734.375)
G7/G7' (4408.125/4708.125)	G18/G18' (4421.875/4721.875)	G29/G29' (4435.625/4735.625)
G8/G8' (4409.375/4708.375)	G19/G19' (4423.125/4721.125)	G30/G30' (4436.875/4736.875)
G9/G9' (4410.625/4710.625)	G20/G20' (4424.375/4724.375)	G31/G31' (4438.125/4738.125)
G10/G10' (4411.875/4711.875)	G21/G21' (4425.625/4725.625)	G32/G32' (4439.375/4739.375)
G11/G11' (4413.125/4713.125)	G22/G22' (4426.875/4726.875)	
Third Priority Channels		
G33/G33' (4440.625/4740.625)	G87/G87' (4508.125/4808.125)	G141/G141' (4575.625/4875.625)
G34/G34' (4441.875/4741.875)	G88/G88' (4509.375/4809.375)	G142/G142' (4576.875/4876.875)
G35/G35' (4443.125/4743.125)	G89/G89' (4510.675/4810.675)	G143/G143' (4578.125/4878.125)
G36/G36' (4444.375/4744.375)	G90/G90' (4511.875/4811.875)	G144/G144' (4579.375/4879.375)
G37/G37' (4445.625/4745.625)	G91/G91' (4513.125/4813.125)	G145/G145' (4580.625/4880.625)
G38/G38' (4446.875/4746.875)	G92/G92' (4514.625/4814.625)	G146/G146' (4581.875/4881.875)
G39/G39' (4448.125/4748.125)	G93/G93' (4515.625/4815.625)	G147/G147' (4583.125/4883.125)
G40/G40' (4449.375/4748.375)	G94/G94' (4516.875/4816.875)	G148/G148' (4584.375/4884.375)
G41/G41' (4450.625/4750.625)	G95/G95' (4518.125/4818.125)	G149/G149' (4585.625/4885.625)
G42/G42' (4451.875/4751.875)	G96/G96' (4519.375/4819.375)	G150/G150' (4586.875/4886.875)
G43/G43' (4453.125/4753.125)	G97/G97' (4520.625/4820.625)	G151/G151' (4588.125/4888.125)
G44/G44' (4454.375/4754.375)	G98/G98' (4521.875/4821.875)	G152/G152' (4589.375/4889.375)
G45/G45' (4455.625/4755.625)	G99/G99' (4523.125/4823.125)	G153/G153' (4590.625/4890.625)
G46/G46' (4456.875/4756.875)	G100/G100' (4524.375/4824.375)	G154/G154' (4591.875/4891.875)
G47/G47' (4458.125/4758.125)	G101/G101' (4525.625/4825.625)	G155/G155' (4593.125/4893.125)
G48/G48' (4459.375/4759.375)	G102/G102' (4526.875/4826.875)	G156/G156' (4594.375/4894.375)
G49/G49' (4460.625/4760.625)	G103/G103' (4528.125/4828.125)	G157/G157' (4595.625/4895.625)
G50/G50' (4461.875/4761.875)	G104/G104' (4529.375/4829.375)	G158/G158' (4596.875/4896.875)
G51/G51' (4463.125/4763.125)	G105/G105' (4530.625/4830.625)	G159/G159' (4598.125/4898.125)
G52/G52' (4464.375/4764.375)	G106/G106' (4531.875/4831.875)	G160/G160' (4599.375/4899.375)
G53/G53' (4465.625/4765.625)	G107/G107' (4533.125/4833.125)	G161/G161' (4600.625/4900.625)
G54/G54' (4466.875/4766.875)	G108/G108' (4534.375/4834.375)	G162/G162' (4601.875/4901.875)
G55/G55' (4468.125/4768.125)	G109/G109' (4535.625/4835.625)	G163/G163' (4603.125/4903.125)
G57/G57' (4470.625/4770.625)	G110/G110' (4536.875/4836.875)	G164/G164' (4604.375/4904.375)
G58/G58' (4471.875/4771.875)	G111/G111' (4538.125/4838.125)	G165/G165' (4605.625/4905.625)
G59/G59' (4473.125/4773.125)	G112/G112' (4539.375/4839.375)	G166/G166' (4606.875/4906.875)
G60/G60' (4474.375/4774.375)	G113/G113' (4540.625/4840.625)	G167/G167' (4608.125/4908.125)
G61/G61' (4475.625/4775.625)	G114/G114' (4541.875/4841.875)	G168/G168' (4609.375/4909.375)
G62/G62' (4476.875/4776.875)	G115/G115' (4543.125/4843.125)	G169/G169' (4610.625/4910.625)
G63/G63' (4478.125/4778.125)	G116/G116' (4544.375/4844.375)	G170/G170' (4611.875/4911.875)
G64/G64' (4479.375/4779.375)	G117/G117' (4545.625/4845.625)	G171/G171' (4613.125/4913.125)
G65/G65' (4480.625/4780.625)	G118/G118' (4546.875/4846.875)	G172/G172' (4614.375/4914.375)
G66/G66' (4481.875/4781.875)	G119/G119' (4548.125/4848.125)	G173/G173' (4615.625/4915.625)
G67/G67' (4483.125/4783.125)	G120/G120' (4549.375/4849.375)	G174/G174' (4616.875/4916.875)
G56/G56' (4469.375/4768.375)	G121/G121' (4550.625/4850.625)	G175/G175' (4618.125/4918.125)
G68/G68' (4484.375/4784.375)	G122/G122' (4551.875/4851.875)	G176/G176' (4619.375/4919.375)
G69/G69' (4485.625/4785.625)	G123/G123' (4553.125/4853.125)	G177/G177' (4620.625/4920.625)
G70/G70' (4486.875/4786.875)	G124/G124' (4554.375/4854.375)	G178/G178' (4621.875/4921.875)
G71/G71' (4488.125/4788.125)	G125/G125' (4555.625/4855.625)	G179/G179' (4623.125/4923.125)
G72/G72' (4489.375/4789.375)	G126/G126' (4556.875/4856.875)	G180/G180' (4624.375/4924.375)
G73/G73' (4490.625/4790.625)	G127/G127' (4558.125/4858.125)	G181/G181' (4625.625/4925.625)

<b>Table 7</b>		
<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>
G74/G74' (4491.875/4791.875)	G128/G128' (4559.375/4559.375)	G182/G182' (4626.875/4926.875)
G75/G75' (4493.125/4793.125)	G129/G129' (4560.625/4860.625)	G183/G183' (4628.125/4928.125)
G76/G76' (4494.375/4794.375)	G130/G130' (4561.875/4861.875)	G184/G184' (4629.375/4929.375)
G77/G77' (4495.625/4795.625)	G131/G131' (4563.125/4863.125)	G185/G185' (4630.625/4930.625)
G78/G78' (4496.875/4796.875)	G132/G132' (4564.375/4864.375)	G186/G186' (4631.875/4931.875)
G79/G79' (4498.125/4798.125)	G133/G133' (4565.625/4865.625)	G187/G187' (4633.125/4933.125)
G80/G80' (4499.375/4799.375)	G134/G134' (4566.875/4866.875)	G188/G188' (4634.375/4934.375)
G81/G81' (4500.625/4800.625)	G135/G135' (4568.125/4868.125)	G189/G189' (4635.625/4935.625)
G82/G82' (4501.875/4801.875)	G136/G136' (4569.375/4869.375)	G190/G190' (4636.875/4936.875)
G83/G83' (4503.125/4803.125)	G137/G137' (4570.625/4870.625)	G191/G191' (4638.125/4938.125)
G84/G84' (4504.375/4804.375)	G138/G138' (4571.875/4871.825)	G192/G192' (4639.375/4939.375)
G85/G85' (4505.625/4805.625)	G139/G139' (4573.125/4873.125)	
G86/G86' (4506.875/4806.875)	G140/G140' (4574.375/4874.375)	

c. Table 8 shows the center frequencies of the unpaired or single channels in the 4400-4940 MHz Channel Plan and their respective channel status.

## CENTER FREQUENCIES OF THE UNPAIRED OR SINGLE CHANNELS

**Table 8: The Center Frequencies for the Unpaired or Single Channels in the 4400-4940 MHz Channel Plan**

<b>Table 8</b>		
<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>	<b>Channel (Frequency in MHz)</b>
<b>30 MHz Channels (Third Priority B-Channels)</b>		
B9 (4655)	B10 (4685)	
<b>20 MHz Channels (Third Priority C-Channels)</b>		
C13 (4650)	C14 (4670)	C15 (4690)
<b>10 MHz Channels (First Priority D-Channels)</b>		
D25 (4645)	D27 (4665)	D29 (4685)
D26 (4655)	D28 (4675)	D30 (4695)
<b>5 MHz Channels (First Priority E-Channels)</b>		
E49 (4642.5)	E53 (4662.5)	E57 (4682.5)
E50 (4647.5)	E54 (4667.5)	E58 (4687.5)
E51 (4652.5)	E55 (4672.5)	E59 (4692.5)
E52 (4657.5)	E56 (4677.5)	E60 (4697.5)
<b>2.5 MHz Channels (First Priority F-Channels)</b>		
F97 (4641.25)	F105 (4661.25)	F113 (4681.25)
F98 (4643.75)	F106 (4663.75)	F114 (4683.75)
F99 (4646.25)	F107 (4666.25)	F115 (4686.25)
F100 (4648.75)	F108 (4668.75)	F116 (4688.75)
F101 (4651.25)	F109 (4671.25)	F117 (4691.25)
F102 (4653.75)	F110 (4673.75)	F118 (4693.75)
F103 (4656.25)	F111 (4676.25)	F119 (4696.25)
F104 (4658.75)	F112 (4678.75)	F120 (4698.75)
<b>1.25 MHz Channels (First Priority G-Channels)</b>		
G193 (4640.625)	G209 (4660.625)	G225 (4680.625)
G194 (4641.875)	G210 (4661.875)	G226 (4681.875)

Table 8		
Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
G195 (4643.125)	G211 (4663.125)	G227 (4683.125)
G196 (4644.375)	G212 (4664.375)	G228 (4684.375)
G197 (4645.625)	G213 (4665.625)	G229 (4685.625)
G198 (4646.875)	G214 (4666.875)	G230 (4686.875)
G199 (4648.125)	G215 (4668.125)	G231 (4688.125)
G200 (4649.375)	G216 (4669.375)	G232 (4689.375)
G201 (4650.625)	G217 (4670.625)	G233 (4690.625)
G202 (4651.875)	G218 (4671.875)	G234 (4691.875)
G203 (4653.125)	G219 (4673.125)	G235 (4693.125)
G204 (4654.375)	G220 (4674.375)	G236 (4694.375)
G205 (4655.625)	G221 (4675.625)	G237 (4695.625)
G206 (4656.875)	G222 (4676.875)	G238 (4696.875)
G207 (4658.125)	G223 (4678.125)	G239 (4698.125)
G208 (4659.375)	G224 (4679.375)	G240 (4699.375)

#### 4.3.19 7125-8500 MHz Channel Plan and Frequency Assignment Process

This section describes the 7125-8500 MHz Channel Plan for stations operating in the fixed service and provides guidance on its implementation. This Channel Plan became effective on December 1, 2009, and all incumbent frequency assignments in the band 7125-8500 MHz are grandfathered until the equipment or frequency is changed.<sup>9</sup>

The Channel Plan was revised in June 2019 to include 40, 50 and 60 MHz bandwidth channels and certain unpaired-channel uses. The procedures of frequency selections and guidelines were updated to incorporate the changes at same time. The revision also included requirement for adopting technologies like Adaptive Code Modulation (ACM) and Automatic Transmit Power Control (ATPC) in the fixed radio systems

2. Figure 1 and 2 provide an overview of the 7125-8500 MHz Channel Plan. The plan consists of the 7125-7750 MHz (7GHz) Channel Plan (Figure 1) and the 7750-8500 MHz (8GHz) Channel Plan (Figure 2). Detail frequencies for each channel are shown in the tables in the following sections.

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<sup>9</sup> Any system in the Government Master File (GMF) or on the Frequency Assignment Subcommittee (FAS) agenda before December 1, 2009, are grandfathered.

Figure 1: 7 GHz Channel Plan

LOW BAND (7GHz Channel Plan)																																																																																																																																																										
Allocation (MHz)	7125		7145												7190												7235		7250												7300												7450																																																																																																					
	Primary																																								Secondary										Primary																																																																																																							
Sub-band <sup>1</sup> (Width)	1 (20MHz)		2 (45MHz)										3 (45MHz)										4 (15MHz)					5 (50MHz)										6 (150MHz)																																																																																																																				
Channel Frequency Range	7125 MHz		7150 MHz		7180 MHz										7210 MHz										7240 MHz					7270 MHz					7300 MHz					7330 MHz					7360 MHz					7390 MHz					7420 MHz					7450 MHz																																																																																														
60 MHz (R)					R1										R3										R5										R7										R9																																																																																																													
60 MHz (R)					R2										R4										R6										R8																																																																																																																							
50 MHz (H)					H1					H3					H5					H7					H9					H11																																																																																																																												
50 MHz (H)					H2					H4					H6					H8					H10																																																																																																																																	
40 MHz (G)					G1					G3					G5					G7					G9					G11					G13																																																																																																																							
40 MHz (G)					G2					G4					G6					G8					G10					G12					G14																																																																																																																							
30 MHz (A)					A1					A2					A3					A4					A5					A6					A7					A8					A9					A10																																																																																																								
20 MHz (B)					B1					B2					B3					B4					B5					B6					B7					B8					B9					B10					B11					B12					B13					B14					B15																																																																															
10 MHz (C)					C1					C2					C3					C4					C5					C6					C7					C8					C9					C10					C11					C12					C13					C14					C15					C16					C17					C18					C19					C20					C21					C22					C23					C24					C25					C26					C27					C28					C29					C30				
5 MHz (D)					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17																																																																																																																																					
2.5 MHz (E)	12	34	56	78	90	12	34	56	78	90	12	34	56	78	90	12	34	Paired channel will be implemented for fixed services as A1(Lo)/A1'(Hi), B1(Lo)/B1'(Hi), etc.																																																																																																																																								

HIGH BAND (7GHz Channel Plan)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Allocation (MHz)	7450										7550										7750																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Sub-band <sup>1</sup> (Width)											7 (100MHz)										8 (200MHz)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Channel Frequency Range	7450 MHz										7480 MHz										7510 MHz										7540 MHz										7570 MHz										7600 MHz										7630 MHz										7660 MHz										7690 MHz										7720 MHz										7750 MHz																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
60 MHz (R)					R1'										R3'										R5'										R7'										R9'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
60 MHz (R)					R2'										R4'										R6'										R8'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
50 MHz (H)					H1'					H3'					H5'					H7'					H9'					H11'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
50 MHz (H)					H2'					H4'					H6'					H8'					H10'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
40 MHz (G)					G1'					G3'					G5'					G7'					G9'					G11'					G13'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
40 MHz (G)					G2'					G4'					G6'					G8'					G10'					G12'					G14'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
30 MHz (A)					A1'					A2'					A3'					A4'					A5'					A6'					A7'					A8'					A9'					A10'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
20 MHz (B)					B1'					B2'					B3'					B4'					B5'					B6'					B7'					B8'					B9'					B10'					B11'					B12'					B13'					B14'					B15'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
10 MHz (C)					C1'					C2'					C3'					C4'					C5'					C6'					C7'					C8'					C9'					C10'					C11'					C12'					C13'					C14'					C15'					C16'					C17'					C18'					C19'					C20'					C21'					C22'					C23'					C24'					C25'					C26'					C27'					C28'					C29'					C30'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
5 MHz (D)					6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'	21'	22'	23'	24'	25'	26'	27'	28'	29'	30'	31'	32'	33'	34'	35'	36'	37'	38'	39'	40'	41'																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
2.5 MHz (E)	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12	34	56	78	90	11	12



LOW BAND (8GHz Channel Plan)																																																																																																															
Allocation (MHz)		7750									7850									7900									8025									8110																																																																									
		Primary																		Secondary																		Primary																																																																									
Sub-band <sup>1</sup> (Width)		9 (100MHz)									10 (50MHz)									11 (125 MHz)																		12 (150 MHz)																																																																									
Channel Frequency Range		7750 MHz	7780 MHz	7810 MHz	7840 MHz	7870 MHz	7900 MHz	7930 MHz	7960 MHz	7990 MHz	8020 MHz	8050 MHz	8080 MHz	8110 MHz																																																																																																	
60 MHz (R)		R10			R12			R14			R16			R18			R20																																																																																														
60 MHz (R)		R11			R13			R15			R17			R19																																																																																																	
50 MHz (H)		H12			H14			H16			H18			H20			H22			H24																																																																																											
50 MHz (H)		H13			H15			H17			H19			H21			H23																																																																																														
40 MHz (G)		G15			G17			G19			G21			G23			G25			G27			G29			G31																																																																																					
40 MHz (G)		G16			G18			G20			G22			G24			G26			G28			G30																																																																																								
30 MHz (A)		A11		A12		A13		A14		A15		A16		A17		A18		A19		A20		A21		A22																																																																																							
20 MHz (B)		B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32	B33																																																																																												
10 MHz (C)		C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47	C48	C49	C50	C51	C52	C53	C54	C55	C56	C57	C58	C59	C60	C61	C62	C63	C64	C65	C66																																																																										
5 MHz (D)														42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89																																																		
2.5 MHz (E)														8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95										

HIGH BAND (8GHz Channel Plan)																																																																								
Allocation (MHz)		8110									8175									8215									8400									8500																																		
		Primary																																																																						
Sub-band <sup>1</sup> (Width)		12 (150MHz)									13 (40MHz)									14 (185MHz)																		15 (50 MHz)									16 (50 MHz)																									
Channel Frequency Range		8110 MHz			8170 MHz		8200 MHz		8230 MHz		8260 MHz		8290 MHz		8320 MHz		8350 MHz		8380 MHz		8410 MHz		8440 MHz		8470 MHz	8480 MHz	8490 MHz	8500 MHz																																												
60 MHz (R)		R10'			R12'			R14'			R16'			R18'			R20'																																																							
60 MHz (R)		R11'			R13'			R15'			R17'			R19'																																																										
50 MHz (H)		H12'			H14'			H'16			H18'			H20'			H22'			H24'																																																				
50 MHz (H)		H13'			H'15			H17'			H19'			H21'			H23'																																																							
40 MHz (G)		G15'			G17'			G'19			G21'			G23'			G25'			G27'			G29'			G31'																																														
40 MHz (G)		G16'			G18'			G20'			G22'			G24'			G26'			G28'			G30'																																																	
30 MHz (A)		A11'		A12'		A13'		A14'		A15'		A16'		A17'		A18'		A19'		A20'		A21'		A22'																																																
20 MHz (B)		B16'	B17'	B18'	B19'	B20'	B21'	B22'	B23'	B24'	B25'	B26'	B27'	B28'	B29'	B30'	B'31	B'32	B'33																																																					
10 MHz (C)		C31'	C32'	C33'	C34'	C35'	C36'	C37'	C38'	C39'	C40'	C41'	C42'	C43'	C44'	C45'	C46'	C47'	C48'	C49'	C50'	C51'	C52'</																																																	

#### 4.3.19.1 Procedure for Frequency Selection

The selection of frequencies for fixed service systems (does not include transportable systems) will be performed by NTIA Spectrum Engineering and Analysis Division (SEAD) in conjunction with the NTIA Frequency Assignment Branch (FAB) within 9 workdays of receipt of complete data. The process and coordination procedures are following:

1. The selection of frequency assignments for new fixed services in this band will be performed by SEAD. Any coordinate changes or technical modifications (e.g. update radio parameters, move antenna height, etc.) to the existing fixed service assignments in this band must also be submitted to SEAD for review and possible re-engineering.

2. SEAD will provide the selected frequencies to the requesting agency for review. Upon agreeing to the frequencies identified, the agency will submit the selected frequencies to the FAS using the existing NTIA frequency assignment process. If the submitting agency disagrees with the selected frequencies, the agency will work with SEAD staff members to identify a mutually agreeable frequencies.

3. Agencies must submit the Link ID numbers assigned by SEAD from the selection process when submitting frequency applications to FAS for approval. Agencies must record the link ID number and date on the bottom of SEAD engineering report to its associated serial numbers in the GMF database remark lines.<sup>10</sup>

4. Agencies must record detailed radio model and antenna model information in the GMF database equipment data fields for all assignments.

The federal agency submitting a frequency selection request must provide the following information in card format and/or other preferred formats to [SEADFASupport@ntia.gov](mailto:SEADFASupport@ntia.gov):

- a. Serial numbers for each requested transmit frequency and paired receiver frequency
- b. Transmitter and Receiver site names and coordinates of the proposed location(s) of deployment (antenna locations)
- c. Transmitter and Receiver radio nomenclature, radio manufacturer name and radio manufacturer model number (e.g. Alcatel MDR-87084S-155, Cambrium PTP820, Aviat Eclipse IRU600, Nokia 9500MPR, etc.)
- d. Transmitter and Receiver bandwidth and emission designator (e.g. 10M0G7W, 27M2D1D, 30M0D7W)
- e. Transmitter and Receiver radio modulation type and capacity
  - 1) Specify the use of Adaptive Code Modulation (ACM) in the system (Yes/No)
  - 2) For fixed modulation systems, specify the type of modulation (i.e. QPSK, 64QAM, 256QAM, 2048QAM) and radio capacity (i.e. 45 Mbps, 155 Mbps, 177.4 Mbps, etc.)
  - 3) For ACM systems, indicate the type of modulation used under normal operation or the highest modulation used (i.e. ACM@256QAM, ACM@1024QAM), and its radio capacity (e.g. 155Mbps, 177.4 Mbps, etc.)
- f. Transmitter power (in watts)<sup>11</sup>
  - 1) Specify the use of Automatic Transmit Power Control (ATPC) function (Yes/No)
  - 2) For ACM systems, must provide ACM Coordinated power
  - 3) For non-ATPC systems, must provide Nominal transmit power (at which the system will operate in normal unfaded conditions)
  - 4) For ATPC systems, must provide Nominal transmit power, Coordinated transmit power, Maximum transmit power, ATPC trigger levels (upper and lower, in dBm) and Coordinated Receive Signal

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<sup>10</sup> The Link ID is a seven-digit number for new assignments (e.g. 1008020). But for legacy systems before 2009, the Link ID was formatted with agency name followed by sequence numbers (e.g. AF23, DOE100, etc),

<sup>11</sup> For ATPC requirements and related definitions of terms used here, see details in ANSI/TIA-10 standard (Interference Criteria for Microwave Systems) and NSMA Recommendations WG18.91.032 for ATPC.

Level (RSL, in dBm)

- g. Transmitter Equivalent Isotropically Radiated Power (EIRP in watts): the EIRP must meet the maximum EIRP limit requirement in Section 5.3.3
- h. Transmitter and Receiver antenna model (e.g. Andrew HP6-71W44)
- i. Transmitter and Receiver antenna type
- j. Transmitter and Receiver mainbeam antenna gain (in dBi)
- k. Transmitter and Receiver antenna azimuth in degrees
- l. Transmitter and Receiver antenna heights above ground level (AGL in meters) including the structure heights such as building heights
- m. Transmitter and Receiver antenna ground elevation above mean sea level (AMSL in meters)
- n. Transmitter and Receiver antenna polarization (H – Horizontal, V – Vertical, S – Horizontal and Vertical)
- o. Transmitter and Receiver space diversity (SP) antenna models, gains and heights if the link is in SP configuration.
- p. Repeater information if applicable: station name, station coordinators, ground elevation, reflector model and demension or antenna model for antenna back-to-back type, repeater mounting heights (AGL, in meters)
- q. Losses in dB (common loss, TX loss, RX loss, e.g. waveguide or cable line losses, branch losses, etc.)
- r. Attenuation loss in dB if applicable.

#### **4.3.19.2      Applicable Guidance for Use of Channel Plan**

In implementing the 7125-8500 MHz Channel Plan, the following guidance applies.

1. This channel plan only applies to fixed and/or transportable assignments. This plan does not apply to mobile, airborne, air to ground (i.e. Space to Earth) or ground to air (i.e. Earth to space) operations, however, NTIA encourages that agencies use this channel plan whenever possible.
2. Incumbent fixed and/or transportable assignments will be grandfathered until the end of the life-cycle of the equipment and all replacement equipment will utilize frequencies in accordance with the channel plan. Other assignments should use this channel plan to the extent possible.
3. Any request for changes or modifications to “grandfathered” fixed and/or transportable assignments, except for the frequency, will be governed by existing NTIA procedures. However, if the operating frequency is to be modified, the replacement frequency will be selected in accordance with the channel plan.
4. The First Priority Channels should be considered prior to the other designated channels.
5. The Second Priority Channels should be considered if the First Priority Channels are not available.
6. Fixed and/or transportable fixed assignments for which the emission bandwidth of a channel will use the next available wider channel in the channel plan. For example, an assignment with an emission bandwidth of 24 MHz will use a 30 MHz channel.
7. The channel spacing for symmetric paired-channels (same radio capacity requirements in both directions for duplex links) are 300 MHz in 7GHz band and 360 MHz in 8GHz band. E.g. spacing for pair A1/A1’ is 300MHz, spacing for pair A11/A11’ is 360MHz. This rule applies to all symmetric paired-channels at all bandwidths.
8. For 40, 50 and 60 MHz wide bandwidths, the channels are formed by concatenating two narrower channels such as 40MHz channels are formed by two adjacent 20 MHz channels. See Figure 4.3.19.1 and Figure 4.3.19.2 plan charts for details. Therefore, there is overlapping between two adjacent channels, e.g. channel G1 overlaps channel G2 by 20 MHz bandwidth, G2 overlaps G3 by 20 MHz bandwidth, etc. Further, for each wideband, the Channel Plan is divided into two sets of channels: the odd number channels are the First Priority Channels, and the even number channels are the Second Priority Channels.
9. For single channel applications or asymmetric channel applications that radio capacity requirement in one direction is greater than the other direction for a duplex link, if applicable, the unpaired channels

must be considered first (e.g. A3, D18', A3/D18', or A3/E35') prior to consider using the channels in the symmetric paired-channel pool. The frequency selections will be determined on case-by-case bases.

10. Fixed and/or transportable fixed assignments may either use single unpaired-channels for paired assignments if paired-channels are not available or use paired-channels for one-way or asymmetric channel applications if the unpaired-channels are not available.

11. Experimental stations may use any frequency in the 7125-8500 MHz under the condition that if the equipment/system becomes operational it must comply with the channel plan.

12. Frequency assignments for the fixed services in some sub-bands of 7125-8500 MHz may be subject to coordination with earth stations. See Manual Section 8.3.13 for details.

### 4.3.19.3 Channel Plan Tables

The following tables list the center frequencies of the paired-channels and single unpaired channels for different bandwidths in the 7125-8500 MHz Channel Plan and their priority status.

a. Tables 1 through 5 shows the center frequencies of the paired-channels of bandwidth from 2.5 MHz to 30 MHz.

**Table 1: The Center Frequencies of the 30 MHz Paired Channels<sup>12</sup>**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
A1/A1' (7165 / 7465)	A7/A7' (7345 / 7645)	A9/A9' (7405 / 7705)
A2/A2' (7195 / 7495)	A8/A8' (7375 / 7675)	A10/A10' (7435 / 7735)
<b>SECOND PRIORITY CHANNELS</b>		
A11/A11' (7765 / 8125)	A13/A13' (7825 / 8185)	A21/A21' (8065 / 8425)
A12/A12' (7795 / 8155)	A14/A14' (7855 / 8215)	A22/A22' (8095 / 8455)

**Table 2: The Center Frequencies of the 20 MHz Paired Channels<sup>13</sup>**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
B16/B16' (7760 / 8120)	B18/B18' (7800 / 8160)	B20/B20' (7840 / 8200)
B17/B17' (7780 / 8140)	B19/B19' (7820 / 8180)	B21/B21' (7860 / 8220)
<b>SECOND PRIORITY CHANNELS</b>		
B1/B1' (7160 / 7460)	B11/B11' (7360 / 7660)	B15/B15' (7440 / 7740)
B2/B2' (7180 / 7480)	B12/B12' (7380 / 7680)	B31/B31' (8060 / 8420)
B3/B3' (7200 / 7500)	B13/B13' (7400 / 7700)	B32/B32' (8080 / 8440)

<sup>12</sup> In the situation wherein one site is transmitting and receiving multiple 30 MHz bandwidth (BW) channels, unless a site engineering study is performed, precautions should be taken to allow a minimum transmit-receive (T/R) separation of 60 MHz between the transmit and receive frequencies to ensure sufficient isolation between the transmitter and the receiver. In this case, avoid assigning channels A1/A1' and A10/A10' (T/R = 30 MHz between A1' and A10) or A11/A11' and A22/A22' (T/R = 30 MHz between A11' and A22) at a single site.

<sup>13</sup> In the situation wherein one site is transmitting and receiving multiple 20 MHz BW channels, unless a site engineering study is performed, precautions should be taken to allow a minimum T/R separation of 40 MHz between the transmit and receive frequencies to ensure sufficient isolation between the transmitter and the receiver. In this case, avoid assigning channels B1/B1' and B15/B15' (T/R = 20 MHz between B1' and B15) or B16/B16' and B33/B33' (T/R = 20 MHz between B16' and B33) at a single site.

B10/B10' (7340 / 7640)	B14/B14' (7420 / 7720)	B33/B33' (8100 / 8460)
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**Table 3: The Center Frequencies of the 10 MHz Paired Channels<sup>14</sup>**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
C61/C61' (8055 / 8415)	C63/C63' (8075 / 8435)	
C62/C62' (8065 / 8425)	C64/C64' (8085 / 8445)	
<b>SECOND PRIORITY CHANNELS</b>		
C1 /C1 ' (7155 / 7455)	C24/C24' (7385 / 7685)	C35/C35' (7795 / 8155)
C2 /C2 ' (7165 / 7465)	C25/C25' (7395 / 7695)	C36/C36' (7805 / 8165)
C3 /C3 ' (7175 / 7475)	C26/C26' (7405 / 7705)	C37/C37' (7815 / 8175)
C4 /C4 ' (7185 / 7485)	C27/C27' (7415 / 7715)	C38/C38' (7825 / 8185)
C5 /C5 ' (7195 / 7495)	C28/C28' (7425 / 7725)	C39/C39' (7835 / 8195)
C6 /C6 ' (7205 / 7505)	C29/C29' (7435 / 7735)	C40/C40' (7845 / 8205)
C19/C19' (7335 / 7635)	C30/C30' (7445 / 7745)	C41/C41' (7855 / 8215)
C20/C20' (7345 / 7645)	C31/C31' (7755 / 8115)	C42/C42' (7865 / 8225)
C21/C21' (7355 / 7655)	C32/C32' (7765 / 8125)	C65/C65' (8095 / 8455)
C22/C22' (7365 / 7665)	C33/C33' (7775 / 8135)	C66/C66' (8105 / 8465)
C23/C23' (7375 / 7675)	C34/C34' (7785 / 8145)	

**Table 4: The Center Frequencies of the 5 MHz Paired Channels**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
D86/D86' (8092.5 / 8452.5)	D88/D88' (8102.5 / 8462.5)	
D87/D87' (8097.5 / 8457.5)	D89/D89' (8107.5 / 8467.5)	
<b>SECOND PRIORITY CHANNELS</b>		
D6 /D6 ' (7152.5 / 7452.5)	D13/D13' (7187.5 / 7487.5)	D80/D80' (8062.5 / 8422.5)
D7 /D7 ' (7157.5 / 7457.5)	D14/D14' (7192.5 / 7492.5)	D81/D81' (8067.5 / 8427.5)
D8 /D8 ' (7162.5 / 7462.5)	D15/D15' (7197.5 / 7497.5)	D82/D82' (8072.5 / 8432.5)
D9 /D9 ' (7167.5 / 7467.5)	D16/D16' (7202.5 / 7502.5)	D83/D83' (8077.5 / 8437.5)
D10/D10' (7172.5 / 7472.5)	D17/D17' (7207.5 / 7507.5)	D84/D84' (8082.5 / 8442.5)
D11/D11' (7177.5 / 7477.5)	D78/D78' (8052.5 / 8412.5)	D85/D85' (8087.5 / 8447.5)
D12/D12' (7182.5 / 7482.5)	D79/D79' (8057.5 / 8417.5)	

**Table 5: The Center Frequencies of the 2.5 MHz Paired Channels**

<sup>14</sup> In the situation wherein one site is transmitting and receiving multiple 10 MHz BW channels, unless a site engineering study is performed, precautions should be taken to allow a minimum T/R separation of 20 MHz between the transmit and receive frequencies to ensure sufficient isolation between the transmitter and the receiver. In this case, avoid assigning channels C1/C1' and C30/C30' (T/R = 10 MHz between C1' and C30) or C31/C31' and C66/C66' (T/R = 10 MHz between C31' and C66) at a single site.

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
E171/E171' (8091.25/8451.25)	E174/E174' (8098.75 / 8458.75)	E177/E177' (8106.25 / 8466.25)
E172/E172' (8093.75/8453.75)	E175/E175' (8101.25 / 8461.25)	E178/E178' (8108.75 / 8468.75)
E173/E173' (8096.25/8456.25)	E176/E176' (8103.75 / 8463.75)	
<b>SECOND PRIORITY CHANNELS</b>		
E11 /E11 ' (7151.25 / 7451.25)	E25 /E25 ' (7186.25 / 7486.25)	E159/E159' (8061.25 / 8421.25)
E12 /E12 ' (7153.75 / 7453.75)	E26 /E26 ' (7188.75 / 7488.75)	E160/E160' (8063.75 / 8423.75)
E13 /E13 ' (7156.25 / 7456.25)	E27 /E27 ' (7191.25 / 7491.25)	E161/E161' (8066.25 / 8426.25)
E14 /E14 ' (7158.75 / 7458.75)	E28 /E28 ' (7193.75 / 7493.75)	E162/E162' (8068.75 / 8428.75)
E15 /E15 ' (7161.25 / 7461.25)	E29 /E29 ' (7196.25 / 7496.25)	E163/E163' (8071.25 / 8431.25)
E16 /E16 ' (7163.75 / 7463.75)	E30 /E30 ' (7198.75 / 7498.75)	E164/E164' (8073.75 / 8433.75)
E17 /E17 ' (7166.25 / 7466.25)	E31 /E31 ' (7201.25 / 7501.25)	E165/E165' (8076.25 / 8436.25)
E18 /E18 ' (7168.75 / 7468.75)	E32 /E32 ' (7203.75 / 7503.75)	E166/E167' (8078.75 / 8438.75)
E19 /E19 ' (7171.25 / 7471.25)	E33 /E33 ' (7206.25 / 7506.25)	E167/E167' (8081.25 / 8441.25)
E20 /E20 ' (7173.75 / 7473.75)	E34 /E34 ' (7208.75 / 7508.75)	E168/E168' (8083.75 / 8443.75)
E21 /E21 ' (7176.25 / 7476.25)	E155/E155' (8051.25 / 8411.25)	E169/E169' (8086.25 / 8446.25)
E22 /E22 ' (7178.75 / 7478.75)	E156/E156' (8053.75 / 8413.75)	E170/E170' (8088.75 / 8448.75)
E23 /E23 ' (7181.25 / 7481.25)	E157/E157' (8056.25 / 8416.25)	
E24 /E24 ' (7183.75 / 7483.75)	E158/E158' (8058.75 / 8418.75)	

b. Tables 6 through 10 shows the center frequencies of the single unpaired-channels of bandwidth from 2.5 MHz to 30 MHz.

**Table 6: The Center Frequencies of the 30 MHz Unpaired Channels**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
A3 (7225)	A6 (7315)	A5' (7585)
A4 (7255)	A3' (7525)	A6' (7615)
A5 (7285)	A4' (7555)	
<b>SECOND PRIORITY CHANNELS</b>		
A15 (7885)	A19 (8005)	A17' (8305)
A16 (7915)	A20 (8035)	A18' (8335)
A17 (7945)	A15' (8245)	A19' (8365)
A18 (7975)	A16' (8275)	A20' (8395)

**Table 7: The Center Frequencies of the 20 MHz Unpaired Channels**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
B22 (7880)	B26 (7960)	B24' (8280)
B23 (7900)	B27 (7980)	B25' (8300)
B24 (7920)	B22' (8240)	B26' (8320)
B25 (7940)	B23' (8260)	B27' (8340)
<b>SECOND PRIORITY CHANNELS</b>		

B4 (7220)	B4' (7520)	B28 (8000)
B5 (7240)	B5' (7540)	B29 (8020)
B6 (7260)	B6' (7560)	B30 (8040)
B7 (7280)	B7' (7580)	B28' (8360)
B8 (7300)	B8' (7600)	B29' (8380)
B9 (7320)	B9' (7620)	B30' (8400)

**Table 8: The Center Frequencies of the 10 MHz Unpaired Channels**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
C55 (7995)	C59 (8035)	C57' (8375)
C56 (8005)	C60 (8045)	C58' (8385)
C57 (8015)	C55' (8355)	C59' (8395)
C58 (8025)	C56' (8365)	C60' (8405)
<b>SECOND PRIORITY CHANNELS</b>		
C7 (7215)	C11' (7555)	C51 (7955)
C8 (7225)	C12' (7565)	C52 (7965)
C9 (7235)	C13' (7575)	C53 (7975)
C10 (7245)	C14' (7585)	C54 (7985)
C11 (7255)	C15' (7595)	C43' (8235)
C12 (7265)	C16' (7605)	C44' (8245)
C13 (7275)	C17' (7615)	C45' (8255)
C14 (7285)	C18' (7625)	C46' (8265)
C15 (7295)	C43 (7875)	C47' (8275)
C16 (7305)	C44 (7885)	C48' (8285)
C17 (7315)	C45 (7895)	C49' (8295)
C18 (7325)	C46 (7905)	C50' (8305)
C7' (7515)	C47 (7915)	C51' (8315)
C8' (7525)	C48 (7925)	C52' (8325)
C9' (7535)	C49 (7935)	C53' (8335)
C10' (7545)	C50 (7945)	C54' (8345)

**Table 9: The Center Frequencies of the 5 MHz Unpaired Channels**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
D1 (7127.5)	D5 (7147.5)	D93' (8487.5)
D2 (7132.5)	D90' (8472.5)	D94' (8492.5)
D3 (7137.5)	D91' (8477.5)	D95' (8497.5)
D4 (7142.5)	D92' (8482.5)	
<b>SECOND PRIORITY CHANNELS</b>		
D42 (7872.5)	D62 (7972.5)	D22' (7532.5)
D43 (7877.5)	D63 (7977.5)	D23' (7537.5)
D44 (7882.5)	D64 (7982.5)	D24' (7542.5)

D45 (7887.5)	D65 (7987.5)	D25' (7547.5)
D46 (7892.5)	D66 (7992.5)	D26' (7552.5)
D47 (7897.5)	D67 (7997.5)	D27' (7557.5)
D48 (7902.5)	D68 (8002.5)	D28' (7562.5)
D49 (7907.5)	D69 (8007.5)	D29' (7567.5)
D50 (7912.5)	D70 (8012.5)	D30' (7572.5)
D51 (7917.5)	D71 (8017.5)	D31' (7577.5)
D52 (7922.5)	D72 (8022.5)	D32' (7582.5)
D53 (7927.5)	D73 (8027.5)	D33' (7587.5)
D54 (7932.5)	D74 (8032.5)	D34' (7592.5)
D55 (7937.5)	D75 (8037.5)	D35' (7597.5)
D56 (7942.5)	D76 (8042.5)	D36' (7602.5)
D57 (7947.5)	D77 (8047.5)	D37' (7607.5)
D58 (7952.5)	D18' (7512.5)	D38' (7612.5)
D59 (7957.5)	D19' (7517.5)	D39' (7617.5)
D60 (7962.5)	D20' (7522.5)	D40' (7622.5)
D61 (7967.5)	D21' (7527.5)	D41' (7627.5)

**Table 10: The Center Frequencies of the 2.5 MHz Unpaired Channels**

Channel (Frequency in MHz)	Channel (Frequency in MHz)	Channel (Frequency in MHz)
<b>FIRST PRIORITY CHANNELS</b>		
E1 (7126.25)	E9 (7146.25)	E137' (8486.25)
E2 (7128.75)	E10 (7148.75)	E138' (8488.75)
E3 (7131.25)	E131' (8471.25)	E139' (8491.25)
E4 (7133.75)	E132' (8473.75)	E140' (8493.75)
E5 (7136.25)	E133' (8476.25)	E141' (8496.25)
E6 (7138.75)	E134' (8478.75)	E142' (8498.75)
E7 (7141.25)	E135' (8481.25)	
E8 (7143.75)	E136' (8483.75)	
<b>SECOND PRIORITY CHANNELS</b>		
E83 (7871.25)	E123 (7971.25)	E43' (7531.25)
E84 (7873.75)	E124 (7973.75)	E44' (7533.75)
E85 (7876.25)	E125 (7976.25)	E45' (7536.25)
E86 (7878.75)	E126 (7978.75)	E46' (7538.75)
E87 (7881.25)	E127 (7981.25)	E47' (7541.25)
E88 (7883.75)	E128 (7983.75)	E48' (7543.75)
E89 (7886.25)	E129 (7986.25)	E49' (7546.25)
E90 (7888.75)	E130 (7988.75)	E50' (7548.75)
E91 (7891.25)	E131 (7991.25)	E51' (7551.25)
E92 (7893.75)	E132 (7993.75)	E52' (7553.75)
E93 (7896.25)	E133 (7996.25)	E53' (7556.25)
E94 (7898.75)	E134 (7998.75)	E54' (7558.75)
E95 (7901.25)	E135 (8001.25)	E55' (7561.25)
E96 (7903.75)	E136 (8003.75)	E56' (7563.75)
E97 (7906.25)	E137 (8006.25)	E57' (7566.25)
E98 (7908.75)	E138 (8008.75)	E58' (7568.75)



E99 (7911.25)	E139 (8011.25)	E59' (7571.25)
E100 (7913.75)	E140 (8013.75)	E60' (7573.75)
E101 (7916.25)	E141 (8016.25)	E61' (7576.25)
E102 (7918.75)	E142 (8018.75)	E62' (7578.75)
E103 (7921.25)	E143 (8021.25)	E63' (7581.25)
E104 (7923.75)	E144 (8023.75)	E64' (7583.75)
E105 (7926.25)	E145 (8026.25)	E65' (7586.25)
E106 (7928.75)	E146 (8028.75)	E66' (7588.75)
E107 (7931.25)	E147 (8031.25)	E67' (7591.25)
E108 (7933.75)	E148 (8033.75)	E68' (7593.75)
E109 (7936.25)	E149 (8036.25)	E69' (7596.25)
E110 (7938.75)	E150 (8038.75)	E70' (7598.75)
E111 (7941.25)	E151 (8041.25)	E71' (7601.25)
E112 (7943.75)	E152 (8043.75)	E72' (7603.75)
E113 (7946.25)	E153 (8046.25)	E73' (7606.25)
E114 (7948.75)	E154 (8048.75)	E74' (7608.75)
E115 (7951.25)	E35' (7511.25)	E75' (7611.25)
E116 (7953.75)	E36' (7513.75)	E76' (7613.75)
E117 (7956.25)	E37' (7516.25)	E77' (7616.25)
E118 (7958.75)	E38' (7518.75)	E78' (7618.75)
E119 (7961.25)	E39' (7521.25)	E79' (7621.25)
E120 (7963.75)	E40' (7523.75)	E80' (7623.75)
E121 (7966.25)	E41' (7526.25)	E81' (7626.25)
E122 (7968.75)	E42' (7528.75)	E82' (7628.75)

c. Tables 11 through 14 shows the center frequencies of the 40, 50 and 60 MHz bandwidth Channel Plans. The non-overlapping adjacent channels in the plan refer to pair G1/G1' to pair G3/G3', pair G2/G2' to pair G4/G4', pair H1/H1' to pair H3/H3', and so on. Details are in the tables below.

**Table 11 The Center Frequencies of the 40 MHz Paired Channels**

Channel (Frequency) in MHz	Channel (Frequency) in MHz	Channel (Frequency) in MHz
<b>FIRST PRIORITY CHANNELS</b>		
G1/G1' (7170 / 7470)	G13/G13' (7410 / 7710)	G29/G29' (8050 / 8410)
G3/G3' (7210 / 7510)	G15/G15' (7770 / 8130)	G31/G31' (8090 / 8450)
G9/G9' (7330 / 7630)	G17/G17' (7810 / 8170)	
G11/G11' (7370 / 7670)	G19/G19' (7850 / 8210)	
<b>SECOND PRIORITY CHANNELS</b>		
G2/G2' (7190 / 7490)	G12/G12' (7390 / 7690)	G18/G18' (7830 / 8190)
G4/G4' (7230 / 7530)	G14/G14' (7430 / 7730)	G20/G20' (7870 / 8230)
G10/G10' (7350 / 7650)	G16/G16' (7790 / 8150)	G30/G30' (8070 / 8430)

**Table 12 The Center Frequencies of the 50 MHz Paired Channels**

Channel (Frequency) in MHz	Channel (Frequency) in MHz	Channel (Frequency) in MHz
<b>FIRST PRIORITY CHANNELS</b>		
H1/H1' (7175 / 7475)	H9/H9' (7375 / 7675)	H15/H15' (7850 / 8210)

H3/H3' (7225 / 7525)	H11/H11' (7425 / 7725)	H23/H23' (8050 / 8410)
H7/H7' (7325 / 7625)	H13/H13' (7800 / 8160)	
<b>SECOND PRIORITY CHANNELS</b>		
H2/H2' (7200 / 7500)	H12/H12' (7775 / 8135)	H24/H24' (8075 / 8435)
H8/H8' (7350 / 7650)	H14/H14' (7825 / 8185)	
H10/H10' (7400 / 7700)	H16/H16' (7875 / 8235)	

**Table 13 The Center Frequencies of the 60MHz Paired Channels**

Channel (Frequency) in MHz	Channel (Frequency) in MHz	Channel (Frequency) in MHz
<b>FIRST PRIORITY CHANNELS</b>		
R1/R1' (7180 / 7480)	R9/R9' (7420 / 7720)	R13/R13' (7870 / 8230)
R7/R7' (7360 / 7660)	R11/R11' (7810 / 8170)	R19/R19' (8050 / 8410)
<b>SECOND PRIORITY CHANNELS</b>		
R2/R2' (7210 / 7510)	R8/R8' (7390 / 7690)	R12/R12' (7840 / 8200)
R6/R6' (7330 / 7630)	R10/R10' (7780 / 8140)	R20/R20' (8080 / 8440)

**Table 14 The Center Frequencies of the 40, 50 and 60 MHz Bandwidth Unpaired Channels**

UnPaired Channels (Frequencies) in 40,50 and 60 MHz Bandwidth Channel Plan			
Channel (Frequency) in MHz	Channel (Frequency) in MHz	Channel (Frequency) in MHz	Channel (Frequency) in MHz
<b><u>40 MHz</u></b>			
G5 (7270)	G6 (7290)	G7 (7310)	G8 (7330)
G5' (7570)	G6' (7590)	G7' (7610)	G8' (7630)
G21 (7890)	G22 (7920)	G23 (7930)	G24 (7950)
G25 (7970)	G26 (7990)	G27 (8010)	G28 (8030)
G21' (8250)	G22' (8270)	G23' (8290)	G24' (8310)
G25' (8330)	G26' (8350)	G27' (8370)	G28' (8390)
<b><u>50 MHz</u></b>			
H4 (7250)	H5 (7275)	H6 (7300)	H4' (7550)
H5' (7575)	H6' (7600)	H17 (7900)	H18 (7925)
H19 (7950)	H20 (7975)	H21 (8000)	H22 (8025)
H17' (8260)	H18' (8285)	H19' (8310)	H20' (8335)
H21' (8360)	H22' (8385)		
<b><u>60 MHz</u></b>			
R3 (7240)	R4 (7270)	R5 (7300)	R3' (7540)
R4' (7570)	R5' (7600)	R14 (7900)	R15 (7930)
R16 (7960)	R17 (7990)	R18 (8020)	R14' (8260)
R15' (8290)	R16' (8320)	R17' (8350)	R18' (8380)

d. Unpaired-channels in Table 6 through 8 and Table 14 can be paired to use as symmetric paired-channels when symmetric paired-channels are not available, i.e. in congested areas or for frequency diversity configuration. Table 15 and Table 16 are showing center frequencies for unpaired-channels used as paired-channels.

**Table 15 The Center Frequencies of the Unpaired Channel in the 10, 20 and 30 MHz Bandwidth Used as Symmetric Paired Channels**

<b>30MHz Bandwidth Channel (Frequency) in MHz</b>	<b>20MHz Bandwidth Channel (Frequency) in MHz</b>	<b>10MHz Bandwidth Channel (Frequency) in MHz</b>	<b>10MHz Bandwidth (cont') Channel (Frequency) in MHz</b>
A3/A3' (7225 / 7525)	B4/B4' (7220 / 7520)	C7/C7' (7215 / 7515)	C46/C46' (7905 / 8265)
A4/A4' (7255 / 7555)	B5/B5' (7240 / 7540)	C8/C8' (7225 / 7525)	C47/C47' (7915 / 8275)
A5/A5' (7285 / 7585)	B6/B6' (7260 / 7560)	C9/C9' (7235 / 7535)	C48/C48' (7925 / 8285)
A6/A6' (7315 / 7615)	B7/B7' (7280 / 7580)	C10/C10' (7245 / 7545)	C49/C49' (7935 / 8295)
A15/A15' (7885 / 8245)	B8/B8' (7300 / 7600)	C11/C11' (7255 / 7555)	C50/C50' (7945 / 8305)
A16/A16' (7915 / 8275)	B9/B9' (7320 / 7620)	C12/C12' (7265 / 7565)	C51/C51' (7955 / 8315)
A17/A17' (7945 / 8305)	B22/B22' (7880 / 8240)	C13/C13' (7275 / 7575)	C52/C52' (7965 / 8325)
A18/A18' (7975 / 8335)	B23/B23' (7900 / 8260)	C14/C14' (7285 / 7585)	C53/C53' (7975 / 8335)
A19/A19' (8005 / 8365)	B24/B24' (7920 / 8280)	C15/C15' (7295 / 7595)	C54/C54' (7985 / 8345)
A20/A20' (8035 / 8395)	B25/B25' (7940 / 8300)	C16/C16' (7305 / 7605)	C55/C55' (7995 / 8355)
	B26/B26' (7960 / 8320)	C17/C17' (7315 / 7615)	C56/C56' (8005 / 8365)
	B27/B27' (7980 / 8340)	C18/C18' (7325 / 7625)	C57/C57' (8015 / 8375)
	B28/B28' (8000 / 8360)	C43/C43' (7875 / 8235)	C58/C58' (8025 / 8385)
	B29/B29' (8020 / 8380)	C44/C44' (7885 / 8245)	C59/C59' (8035 / 8395)
	B30/B30' (8040 / 8400)	C45/C45' (7895 / 8255)	C60/C60' (8045 / 8405)

**Table 16 The Center Frequencies of the Unpaired Channel in the 40, 50 and 60 MHz Bandwidth Used as Symmetric Paired Channels**

<b>40MHz Bandwidth Channel (Frequency) in MHz</b>	<b>50MHz Bandwidth Channel (Frequency) in MHz</b>	<b>60MHz Bandwidth Channel (Frequency) in MHz</b>
G5/G5' (7250 / 7550)	H4/H4' (7250 / 7550)	R3/R3' (7240 / 7540)
G6/G6' (7270 / 7570)	H5/H5' (7275 / 7575)	R4/R4' (7270 / 7570)
G7/G7' (7290 / 7590)	H6/H6' (7300 / 7600)	R5/R5' (7300 / 7600)
G8/G8' (7310 / 7610)	H17/H17' (7900 / 8260)	R14/R14' (7900 / 8260)
G21/G21' (7890 / 8250)	H18/H18' (7925 / 8285)	R15/R15' (7930 / 8290)
G22/G22' (7910 / 8270)	H19/H19' (7950 / 8310)	R16/R16' (7960 / 8320)
G23/G23' (7930 / 8290)	H20/H20' (7975 / 8335)	R17/R17' (7990 / 8350)
G24/G24' (7950 / 8310)	H21/H21' (8000 / 8360)	R18/R18' (8020 / 8380)
G25/G25' (7970 / 8330)	H22/H22' (8025 / 8385)	
G26/G26' (7990 / 8350)		
G27/G27' (8010 / 8370)		
G28/G28' (8030 / 8390)		

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## **Chapter 5**

### **Spectrum Standards**

#### **5.1 GENERAL**

##### **5.1.1 Introduction**

1. This chapter contains Radio Frequency Spectrum Standards applicable to federal radio stations and systems.
2. A radio frequency spectrum standard is a principle, rule, or criterion that bounds the spectrum-related parameters, and characteristics, of a radio station or system for the purpose of managing the Radio Frequency Spectrum. Application of spectrum standards include:
  - a. Assisting consideration of telecommunications systems for the National spectrum review process (Chapter 10),
  - b. Systems planning, design, and procurement,
  - c. Consideration of protection devices for the transmission of classified, and/or sensitive but unclassified information, and their spectrum needs.
3. The standards contained herein are those associated with the potential impact of any system or station on the normal operation of other systems or stations.
4. If spectrum standards are not specified in this chapter, the appropriate provisions of the ITU Radio Regulations normally shall apply. If spectrum standards are not specified in this chapter or in the ITU Radio Regulations, the appropriate criteria contained in current Recommendations of the ITU-R shall be used as guidelines.
5. Compliance with standards contained in this chapter may not preclude the occurrence of interference. Therefore, compliance with the standards does not obviate the need for cooperation in resolving and implementing engineering solutions to harmful interference problems (see Section 2.3.7).

##### **5.1.2 Consequences of Non-conformance with the Provisions of this Chapter**

In any instance of harmful interference caused by nonconformance with the provisions of this chapter, the responsibility for eliminating the harmful interference normally shall rest with the agency operating in nonconformance.

##### **5.1.3 Agency Procurement Specifications**

Procurement specifications shall, as a minimum, assure compliance with the appropriate requirements of this chapter. Agencies may promulgate more stringent criteria for their own use.

##### **5.1.4 Measurement Methods**

Spectrum standards for this chapter are referenced to measurement methods in Annex M. Measurement methods referenced in the annex are provided only for clarification and uniform interpretation of the standards. In cases of harmful interference, the agencies involved are expected to utilize these or equivalent, mutually agreed upon, methods of measurement for resolution of any disagreement concerning compliance with the standards. Agencies may, at their discretion, use these measurement methods as minimum qualification test procedures (e.g., as part of factory test procedures).

##### **5.1.5 Terminology**

1. Definitions of Special Terms, Services, and Stations are contained in Chapter 6.

##### **Desired Relationship of Occupied Bandwidth to Necessary Bandwidth**

2. The emission designator(s) associated in the authorization for any particular frequency assignment specifies the value of the necessary bandwidth of emission for the particular type(s) of transmission permitted. The values of

necessary bandwidth are generally idealized. All reasonable effort shall be made in equipment design and operation by federal agencies to maintain the occupied bandwidth of the emission of any authorized transmission as close to the necessary bandwidth as is reasonably practicable. (See Annex J for additional information concerning the method of calculating necessary bandwidth.)

### **Authorized Bandwidth**

3. For purposes of this Manual, the term “authorized bandwidth” is defined as the necessary bandwidth (bandwidth required for the transmission and reception of intelligence) and does not include allowance for transmitter drift or doppler shift. See, Chapter 6, in addition for the definitions of special terms including authorized bandwidth and mean power.

### **Resolution Bandwidth**

4. Resolution bandwidth is the 3 dB bandwidth of the measurement system used, e.g., in power spectral density measurements. The appropriate resolution bandwidth of the measurement system varies depending on the modulation type and frequency band but should not be greater than the necessary bandwidth of the transmitter being measured.

### **Power (RR)**

Power is designated as:

- peak envelope power (PX or pX)
- mean power (PY or pY)
- carrier power (PZ or pZ)

p denotes power expressed in watts.

P denotes power in dB relative to a reference level.

### **Logarithm**

In this chapter,  $\text{Log} = \text{Log}_{10}$

## **5.2 FREQUENCY TOLERANCES AND UNWANTED EMISSIONS**

### **5.2.1 Table of Frequency Tolerances**

1. Frequency tolerance standards applicable to federal stations are specified in Table 5.2.1. The table specifies standards for station types arranged within frequency bands.

2. Transmitter frequency tolerance is the maximum permissible departure from the assigned frequency by the center frequency of the frequency band occupied by an emission.

3. Receiver frequency tolerance is the maximum permissible departure of the center frequency of the IF passband from the desired center frequency of the IF passband.

4. In Table 5.2.1 the units for frequency tolerance are expressed in ( $\pm$ ) parts per million (ppm) unless otherwise stated. For the purpose of this Manual, the “ $\pm$ ” symbol will always be implied. For example,  $\pm 10$  ppm will appear as 10 ppm.

5. The power shown for the various categories of stations is the peak envelope power for single sideband transmitters and the mean power for all other transmitters, unless otherwise indicated. (RR)

**Table 5.2.1 - Table of Frequency Tolerances**

<b>Frequency Band 9 kHz to 535 kHz</b>	<b>Frequency Tolerance</b>
<b>I. Fixed Stations</b>	
A. 9 - 50 kHz	100
B. 50 - 535 kHz	50
<b>II. Mobile Stations</b>	
<b>A. Aeronautical Stations</b>	
1. Aeronautical	50
2. Aircraft	50
3. Survival craft	500
<b>B. Land Mobile Stations</b>	
1. Base (TIS) (530 kHz)	100 Hz
2. Land Mobile	20
3. Direct Printing telegraph and data.	10 Hz
<b>C. Maritime Mobile Stations</b>	
1. Coast	100
2. Ship	
a. Direct printing telegraph and data.	10 Hz
b. Other than above	200
3. Ship Emergency Transmitters	500 (a)
4. Survival Craft	500
<b>III. Radiodetermination Stations</b>	100

<b>Frequency Band 535 kHz to 1605 kHz</b>	<b>Frequency Tolerance</b>
<b>I. Broadcasting Stations</b>	10 Hz (b)

<b>Frequency Band 1605 kHz to 4000 kHz</b>	<b>Frequency Tolerance</b>
<b>I. Fixed Stations</b>	
A. All, except SSB radiotelephone	10
B. SSB radiotelephone	20 Hz
<b>II. Mobile (Aeronautical, Land, Maritime) Stations</b>	
<b>A. Aeronautical Mobile Stations</b>	
1. Aeronautical	
a. $pY \leq 200W$ except SSB radiotelephone	20
b. $pY > 200W$ except SSB radiotelephone	10
c. SSB radiotelephone	10 Hz (c)
2. Aircraft	
a. All except SSB	20
b. SSB radiotelephone	20 Hz (d)
<b>B. Land Mobile Stations</b>	

1. Base	
a. $pY \leq 200W$ , except SSB radiotelephone	20 (e)
b. $pY > 200W$ , except SSB radiotelephone	10
c. SSB radiotelephone	20 Hz
2. Land Mobile	
a. All except SSB	50
b. SSB radiotelephone	20 Hz
<b>C. Maritime Mobile Stations</b>	
1. Coast	
a. $pY \leq 200W$ , except c and d below	100
b. $pY > 200W$ , except c and d below	50
c. SSB Radiotelephone	20 Hz
d. Direct printing telegraph and data	10 Hz
2. Ship	
a. All except below	40 (f)
b. SSB radiotelephone	40 Hz
c. Direct printing radiotelegraphy and data	40 Hz
3. Survival Craft	
a. EPIRB	100
<b>III. Radiodetermination Stations</b>	
<b>A. Radionavigation</b>	
1. $pY \leq 200W$	20
2. $pY > 200W$	10
<b>B. Radiolocation</b>	
	10
<b>IV. Broadcasting Stations</b>	
	10 Hz

<b>Frequency Band 4 to 29.7 MHz</b>	<b>Frequency Tolerance</b>
<b>I. Fixed Stations</b>	
A. $pY \leq 500W$ , except C and D below	20
B. $pY > 500W$ , except C and D below	10
C. SSB/ISB Radiotelephone	20 Hz
D. Class F1B emissions	10 Hz
<b>II. Mobile (Aeronautical, Land, Maritime) Stations</b>	
<b>A. Aeronautical mobile stations</b>	
1. Aeronautical	
a. $pY \leq 500W$ , except SSB	30
b. $pY > 500W$ , except SSB	10
c. SSB Radiotelephone	10 Hz (c)
2. Aircraft	
a. All except SSB	30
b. SSB Radiotelephone	20 Hz
<b>B. Land mobile stations</b>	

1. Base	
a. $pY \leq 500W$ , except SSB	20
b. $pY > 500W$ , except SSB	10
c. SSB Radiotelephone	20 Hz
2. Land Mobile	
a. All except SSB	30
b. SSB Radiotelephone	20 Hz
C. Maritime mobile stations	
1. Coast	
a. SSB radiotelegraph	20 Hz
b. Direct printing telegraph and data	10 Hz
c. Other than above	20 Hz (g)
2. Ship	
a. Class A1A emission	10
b. Other than A1A emissions	
(1) SSB Radiotelephone	50 Hz
(2) Direct printing, telegraphy and data	10 Hz
(3) Other than above	50 Hz (h)
3. Survival craft	50
III. Broadcasting stations	2
IV. Space and earth stations	20

Frequency Band 29.7 to 108 MHz	Frequency Tolerance
I. Fixed stations	
A. 29.7-50 MHz, single-channel analog/digital FM/PM	5 (i)
B. Other than above	
1. $pY \leq 10W$	20
2. $pY > 10W$	5
II. Mobile (Aeronautical, Land, Maritime) Stations	
A. 29.7- 50 MHz, analog and digital FM/PM	
1. Land and mobile	5 (i)
2. Portables	20 (i)
B. Other than above	
1. $pY \leq 10W$	20 (j)
2. $pY > 10W$	5
III. Aeronautical Radionavigation stations (Marker beacons on 75 MHz)	50
IV. Broadcasting stations	
A. TV sound and vision	500 Hz (k)(l)
B. Other than TV	
1. $pY \leq 10 W$	3000 Hz
2. $pY > 10 W$	2000 Hz
V. Space and earth stations	20

Frequency Band 108 to 470 MHz	Frequency Tolerance
I. Fixed stations.	
A. 108 - 406.1 MHz, all except below.	5
B. 138 - 150.8 and 162 - 174 MHz, narrowband analog/digital FM/PM except C below	1.5
C. 162 - 174 MHz, low power and splinter channels	
1. $pY \leq 10W$	5
2. $pY > 10W$	2
D. 406-470 MHz	
1. 406.1-420 MHz	
a. Multi-Channel	2.5 (m)(n)
b. Analog/Digital FM/PM	
(1) Wideband	2.5 (i)
(2) Narrowband	1.0 (o)
2. Other than above	
a. $pY \leq 10 W$	5
b. $pY > 10 W$	2.5
II. Mobile (Aeronautical, Land, Maritime) Stations	
A. Aeronautical mobile stations	
1. Aeronautical	
a. Analog/digital FM/PM	
(1) 162-174 MHz	5(i)
(a) Wideband	1.5(o)
(b) Narrowband	
(2) 406.1-420 MHz	2.5 (i)
(a) Wideband	1.0 (o)
(b) Narrowband	
b. Other than above	20
2. Aircraft	
a. 156-174 and 406.1-420 MHz	
(1) 162-174 MHz analog/digital FM/PM	
(a) Wideband	5(i)
(b) Narrowband	2.5 (o)
(2) 406.1-420 MHz analog/digital FM/PM	
(a) Wideband	5(i)
(b) Narrowband	2.5(o)
b. Other than above	20
B. Land mobile stations	
1. Base	
a. 108 - 406.1 MHz, all except below	5
b. 138-150.8 and 162 - 174 MHz analog/digital FM/PM	
(1) Wideband	5(i)
(2) Narrowband	1.5(o)(v)
c. 162 - 174 MHz, splinter channel	
(1) $pY \leq 10 W$	5
(2) $pY > 10 W$	2
d. 220 - 222 MHz, single-channel, narrowband	0.1



e. 406.1 - 470 MHz	
(1) 406.1 - 420 MHz analog/digital FM/PM (a) Wideband (b) Narrowband	2.5 (i) 1.0 (o)
(2) Other than above (a) $pY \leq 10$ W (b) $pY > 10$ W	5 2.5
2. Land Mobile	
a. 138-150.8 and 162-174 MHz, all except below	5 (j)
b. 138-150.8 and 162-174 MHz, analog/digital FM/PM (1) Wideband (2) Narrowband	5 (i) 2.5 (o)
c. 162 - 174 MHz (splinter channels) (1) $pY \leq 10$ W (2) $pY > 10$ W	5 2
d. 220 - 222 MHz (single channel, narrowband)	1.5 (p)
e. 406.1 - 420 MHz analog/digital FM/PM (1) Wideband (2) Narrowband (a) portable ( $pY \leq 5$ watts) (b) all others	5 (i) 2.5 (o) 2 (o)
f. Other than above	15
C. Maritime mobile stations	
1. Coast	
a. 150.8 - 162.0125 MHz (1) FM (a) $pY < 3$ W (b) $3 \text{ W} \leq pY \leq 50 \text{ W}$  (2) Other than above (a) $pY < 3$ W (b) $3 \text{ W} \leq pY < 100 \text{ W}$ (c) $pY \geq 100 \text{ W}$  b. Outside of 150.8 - 162.0125 MHz (1) 162.0125 - 174 MHz, analog/digital FM/PM (a) Wideband (b) Narrowband (2) 406.1 - 420 MHz, analog/digital FM/PM (a) Wideband (b) Narrowband (3) Other than above	100 (q) 50 (q)  10 5 2.5  5 (i) 1.5 (o)  2.5 (i) 1.0 (o) 10
2. Ship	

a. 150.8 - 162.0125 MHz (FM, $pY < 25$ W) b. 156 - 162.0125 MHz except for above c. 162.0125 - 174 MHz, analog/digital FM/PM (1) Wideband (2) Narrowband d. 406.1 - 420 MHz, analog/digital FM/PM (1) Wideband (2) Narrowband e. 450 - 470 MHz f. Outside above bands	100 (q)(r) 10  5 (i) 2.5 (o)  5 (i) 2 (o) 5 20 (r)
3. Survival craft	
a. 156 - 174 MHz b. Other than above	10 (r) 20 (s)
III. Radiodetermination Stations	
A. Radionavigation stations	
1. Radar	50
2. Other than radar	20
B. Radiolocation stations	
1. Radar	50 (t)
2. Other than radar	50
IV. Broadcasting Stations	
A. TV sound and vision	500 Hz (k)
B. Other than TV	2000 Hz
V. Space and Earth Stations	20

Frequency Band 470 to 960 MHz	Frequency Tolerance
I. Fixed Stations	
A. Point-to-Multipoint (932 - 932.5, 941 - 941.5MHz)	1.5 (n)
B. Point-to-Point (932.5 - 935, 941.5 - 944 MHz)	2.5 (n)
C. Other than above	5
II. Mobile (Aeronautical, Land, Maritime) Stations	
A. Land (Aeronautical, Base, Coast)	5
B. Mobile (Aircraft, Land Mobile, Ship)	
1. $pY \leq 3$ W	20
2. $pY > 3$ W	5
III. Radiolocation Stations	400
IV. Broadcasting Stations	
A. TV Broadcasting	500 Hz (k)
B. TV Broadcasting Translators	200
V. Space and Earth Stations	20

Frequency Band 960 to 1215 MHz	Frequency Tolerance
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I. Aeronautical Radionavigation Stations	
A. Aeronautical and Ship Stations	10
B. Aircraft	50
II. IFF/ATCRBS of similar type station	
A. Interrogators 1030 MHz	200 kHz
B. Transponders 1090 MHz	3 MHz

Frequency Band 1215 to 10500 MHz	Frequency Tolerance
I. Fixed Stations	
A. $pY \leq 100$ W	
1. 1215 to 4000 MHz	30 (n)
2. 4000 MHz to 10500 MHz	50 (n)
B. $pY > 100$ W	10 (n)
II. Mobile (Aeronautical, Land, Maritime) Stations	
A. 1215 to 2450 MHz	20
B. 2450 to 4000 MHz	30
C. 4000 to 10500 MHz	50
III. Radiodetermination Stations	
A. 1215 to 2450 MHz	500
B. 2450 to 4000 MHz	800
C. 4000 to 10500 MHz	1250
IV. Space and Earth Stations	20

Frequency Band 10.5 to 30 GHz	Frequency Tolerance
I. Fixed Stations	
A. 21.2 - 23.6 GHz	300
B. 21.8 – 22.075 GHz and 23 -23.275 GHz	500 (u)
C. Other than above	50 (n)
II. Mobile (Aeronautical, Land, Maritime) Stations	100
III. Radiodetermination Stations	2500
IV. Space and Earth Stations	50

Frequency Band Greater than 30 GHz	Frequency Tolerance
I. Fixed Stations	75
II. Mobile (Aeronautical, Land, Maritime) Stations	150
III. Radiodetermination Stations	5000
IV. Space and Earth Stations	75

### Notes for Frequency Tolerances

- (a) If the emergency transmitter is used as the reserve transmitter for the main transmitter, the tolerance for ship station transmitters applies.
- (b) In the area covered by the North American Regional Broadcasting Agreement (NARBA), the tolerance of 20 Hz may continue to be applied.
- (c) 20 Hz is applicable to other than Aeronautical Mobile (R) frequencies.
- (d) The tolerance for aeronautical stations in the Aeronautical Mobile (R) service is 10 Hz.
- (e) Travelers Information Stations (TIS) on 1610 kHz have a tolerance of 100 Hz.
- (f) For A1A emissions the tolerance is 50 ppm.
- (g) For A1A emissions the tolerance is 10 ppm.
- (h) For ship station transmitters in the band 26.175-27.5 MHz, on board small craft, with a carrier power not exceeding 5 W operating in or near coastal waters and utilizing A3E or F3E and G3E emissions, the frequency tolerance is 40 ppm.
- (i) This tolerance is based on emissions with an analog input and a necessary bandwidth of 16 kHz. Stations with digital inputs may require a different necessary bandwidth, but still must meet all other standards. It does not apply to military equipment used for tactical and/or training operations, FM wireless microphone systems whose  $P_Y < 0.1$  watts, equipment on splinter channels, and fixed stations with multichannel emissions. Also, in the band 162-174 MHz, it does not apply to equipment operating on channels designated for low power systems as set forth in Sections 4.3.8 and 5.3.8, or NOAA Weather Radio Transmitters. The measurement method for the receiver frequency tolerance is contained in paragraph M.2.1.5.1.(b) of Annex M.
- (j) 50 ppm applies to wildlife telemetry with mean power output less than 0.5 W.
- (k) In the case of television stations of:
  - (1) 50 W (vision peak envelope power) or less in the band 29.7-100 MHz;
  - (2) 100 W (vision peak envelope power) or less in the band 100-965 MHz and which receive their input from other television stations or which serve small isolated communities. It may not, for operational reasons, be possible to maintain this tolerance. For such stations, this tolerance is 1000 Hz.
- (l) For transmitters for system M(NTSC) the tolerance is 1000 Hz. However, for low power transmitters using this system note (m) applies.
- (m) The receiver frequency tolerance shall be maintained within 10 ppm.
- (n) See Annex M, paragraph M.2.1.3.1.(a), for the measurement method of (1) multichannel equipment in the 406.1-420 MHz band, (2) point-to-point and point-to-multipoint equipment in the bands 932-935/941-944 MHz, or (3) point-to-point and transportable type equipment operating between 1710 MHz and 15.35 GHz (except for systems designed to use scatter techniques).
- (o) This tolerance is for stations with emissions having a necessary bandwidth of 11 kHz or less. It does not apply to military equipment used for tactical and/or training operations, FM wireless microphone systems whose mean output power does not exceed 0.1 watt, equipment operating on channels designated for low power systems as set forth in Sections 4.3.8 and 5.3.8, and NOAA Weather Radio Transmitter.
- (p) This standard is for narrowband operations with a necessary bandwidth of 4 kHz or less.
- (q) The frequency tolerance standard is for maritime mobile stations using FM emissions in the band 150.8-162.0125 MHz with a necessary bandwidth of less than or equal to 16 kHz. See Annex M, paragraph M.2.1.2, for the measurement method.
- (r) Outside band 156-174 MHz, for transmitters used by on-board communications stations, a tolerance of 5 ppm shall apply.
- (s) For transmitters used by on-board communications stations, a tolerance of 5 ppm applies.
- (t) A frequency tolerance of 10 ppm applies to wind profiler radars operating on the frequency 449 MHz.
- (u) Applies to frequency pairs 21.825 GHz, 23.025 GHz; 21.875 GHz, 23.075 GHz; 21.925 GHz, 23.125 GHz, 21.975 GHz, 23.175 GHz, 22.025 GHz, 23.225 GHz, 22.075 GHz, and 23.275 GHz only.
- (v) Stations already operational, or have been approved by NTIA/SPS shall conform to a 2.5 ppm tolerance standard.

## 5.2.2 Location of Standards for Levels of Unwanted Emissions

### 5.2.2.1 Location of Specific Standards

The location of levels of unwanted emission standards are provided in Table 5.2.2.1 below. The table specifies the section number for each standard by station type.

**Table 5.2.2.1**

<b>Station Type: FIXED STATIONS</b>	<b>Location of Standards</b>
Single Sideband and Independent Sideband Equipment (2-29.7 MHz)	5.3.1
Multichannel (406.1-420 MHz) Point-to-point and point-to-multipoint (932-935/941-944 MHz) Point-to-point and transportable, except for systems using scatter techniques (1.71-15.35 GHz)	5.3.3
Analog or Digital FM/PM Wideband Operations (29.7-50, 162-174, and 406.1-420 MHz)	5.3.6
Analog or Digital FM/PM Narrowband Operations (138-150.8, 162-174, and 406.1-420 MHz)	5.3.7
Low Power Channels and Splinter Channels (162-174 MHz and 406.1-420 MHz)	5.3.8
Telemetry, Terrestrial (1435-1525, 2200-2290, 2310-2320, 2345-2395, 4400-4940, and 5091-5150 MHz)	5.3.9
Analog Transmissions and Low Power Transmit (21.2-23.6 GHz)	5.3.10
Other than above	5.2.2.2

<b>Station Type: LAND and MOBILE STATIONS</b>	<b>Location of Standards</b>
Single Sideband and Independent Sideband Equipment (2-29.7 MHz)	5.3.1
Maritime Mobile Stations using FM (150.8-162.0125 MHz)	5.3.2
Land Mobile, Single Channel Narrowband Operations (220-222 MHz)	5.3.4
Analog or Digital FM/PM Wideband Operations (29.7-50, 162-174, and 406.1-420 MHz)	5.3.6
Analog or Digital FM/PM Narrowband Operations (138-150.8, 162-174 MHz and 406.1-420 MHz)	5.3.7
Low Power Channels and Splinter Channels (162-174 MHz and 406.1-420 MHz)	5.3.8
Telemetry, Terrestrial (1435-1525, 2200-2290, 2310-2320, 2345-2395, 4400-4940, and 5091-5150 MHz)	5.3.9
Other than above	5.2.2.2

<b>Station Type: RADIODETERMINATION STATIONS</b>	<b>Location of Standards</b>
Primary radars including spacebased radars on a case-by-case bases (100 MHz to 40 GHz)	5.5
Other than above	5.2.2.2

<b>Station Type: BROADCASTING STATIONS</b>	<b>Location of Standards</b>
All bands	5.2.2.2
<b>Station Type: EARTH and SPACE STATIONS (excluding spacebased radars)</b>	<b>Location of Standards</b>
Below 470 MHz	5.2.2.2
470 MHz and above	5.6

### 5.2.2.2 General Standards

**Below 29.7 MHz, the following standard applies when no other standard applies**

The mean power of any unwanted emissions supplied to the antenna transmission line, as compared with the mean power of the fundamental, shall be in accordance with the following:

a. On any frequency removed from the assigned frequency by more than 100 percent, up to and including 150 percent of the authorized bandwidth, and the image, at least 25 decibels attenuation;

b. On any frequency removed from the assigned frequency by more than 150 percent, up to and including 300 percent of the authorized bandwidth, and the image, at least 35 decibels attenuation; and

c. On any frequency removed from the assigned frequency by more than 300 percent of the authorized bandwidth, and the image, for transmitters with mean power of 5 kilowatts or greater, at least 80 decibels attenuation; and for transmitters with mean power less than 5 kilowatts, at least  $43+10 \log(pY)$  decibels attenuation (i.e., 50 microwatts absolute level), except that:

(1) For transmitters of mean power of 50 kilowatts or greater and which operate over a frequency range approaching an octave or more, a minimum attenuation of 60 decibels shall be provided and every effort should be made to attain at least 80 decibels attenuation.

(2) For hand portable equipment of mean power less than 5 watts, the attenuation shall be at least 30 decibels, but every effort should be made to attain  $43+10 \log(pY)$  decibels attenuation (i.e., 50 microwatts absolute level).

(3) For mobile transmitters, any unwanted emissions shall be at least 40 decibels below the fundamental without exceeding the value of 200 milliwatts, but every effort should be made to attain  $43+10 \log(pY)$  decibels attenuation (i.e., 50 microwatts absolute level).

(4) When A1A, F1B, or similar types of narrowband emissions are generated in an SSB transmitter, the suppressed carrier may fall more than 300 percent of the authorized bandwidth from the assigned frequency. Under these conditions, the suppressed carrier shall be reduced as much as practicable and shall be at least 50 decibels below the power of the fundamental emission.

## **29.7 MHz and above, the following standard applies when no other standard applies:**

The mean power of any emission supplied to the antenna transmission line, as compared with the mean power of the fundamental, shall be in accordance with the following (above 40 GHz these are design objectives pending further experience at these orders of frequency):

a. On any frequency removed from the assigned frequency by more than 75 percent, up to and including 150 percent, of the authorized bandwidth, and the image, at least 25 decibels attenuation;

b. On any frequency removed from the assigned frequency by more than 150 percent, up to and including 300 percent, of the authorized bandwidth, and the image, at least 35 decibels attenuation; and

c. On any frequency removed from the assigned frequency by more than 300 percent of the authorized bandwidth and the image:

(1) For transmitters with mean power of 5 kilowatts or greater, attenuation shall be at least 80 decibels.

(2) For transmitters with mean power less than 5 kilowatts, spurious output shall not exceed 50 microwatts (i.e.,  $43+10 \log(pY)$ ) decibels attenuation except for frequency modulated maritime mobile radiotelephone equipment above 30 MHz as follows:

(a) The mean power of modulation products falling in any other international maritime mobile channel shall not exceed 10 microwatts for mean transmitter power 20 watts or less.

(b) The mean power of any other unwanted emission on any discrete frequency within the international maritime mobile band shall not exceed 2.5 microwatts for transmitters with mean power of 20 watts or less.

(c) For maritime mobile transmitters of mean power above 20 watts, these 2.5 and 10 microwatt limits may be increased in proportion to the increase of the mean power of the transmitters above these 20 watts.

## **5.3 FIXED AND MOBILE STATIONS**

### **5.3.1 HF Single Sideband and Independent Sideband Equipment (2-29.7 MHz)**

This standard specifies that spectrum standards for single sideband equipment for single channel voice, direct printing telegraphy and data, in the Fixed and Mobile services between 2 and 29.7 MHz (Except in the bands allocated exclusively to the Aeronautical Mobile (R) service.) In using the spectrum standards indicated below, it should be recognized that they do not prohibit an agency from making improvements thereon.

### 5.3.1.1 Transmitter Standards

1. For unwanted emissions for fixed and mobile services (except the land mobile service), the peak power of any emission on any frequency removed from the center of the authorized bandwidth<sup>1</sup> (BW) by a displacement frequency ( $f_d$  in kHz) shall be attenuated below the peak envelope power (pX) of the transmitter in accordance with the following schedule:

<b><math>f_d</math> in kHz</b>	<b>Attenuation in dB</b>
$50\%BW < f_d < 150\%BW$	26
$150\%BW < f_d \leq 250\%BW$	35
$f_d > 250\% BW$	$40 + 10 \log(pX)$ or 80 whichever is the lesser attenuation

2. Figure 5.3.1 below provides an example of HF SSB emission plotted using the measurement method described in Annex M. The figure also shows the standard superimposed on the plot to show conformance.

3. For the land mobile service, the peak power of any emission on any frequency removed from the center of the authorized bandwidth<sup>1</sup> (BW) by a displacement frequency ( $f_d$  in kHz) shall be attenuated below the peak envelope power (pX) of the transmitter in accordance with the following schedule:

<b><math>f_d</math> in kHz</b>	<b>Attenuation in dB</b>
1.75 kHz $f_d \leq 5.25$ kHz	28
5.25 kHz $f_d \leq 8.75$ kHz	38
$f_d > 8.75$ kHz	$43 + 10 \log(pX)$

4. Where suppressed carrier operation is employed, transmitters shall be capable of operation with the emitted carrier power attenuated at least 40 dB below peak envelope power.

5. Where interoperability with conventional double sideband AM receivers is required, single sideband transmitters shall have the capability to transmit the carrier at a level within 6 dB of the peak envelope power.

6. The upper sideband mode shall be employed where there is need for working among international services.

### 5.3.1.2 Receiver Standards

1. Selectivity. The passband<sup>2</sup> shall be no greater than the authorized bandwidth of emission and the slope of the selectivity characteristic outside the passband shall be 100 dB/kHz.

2. Tunability. The equipment shall be capable of operation on any frequency within its tuning range. However, where a synthesizer is employed as the frequency controlling element, the receiver shall be capable of operation on any frequency which is an integral multiple of 0.1 kHz.

### 5.3.1.3 Antenna Standards<sup>3</sup>

#### 1. Fixed Station

a. Directive antennas are not required below 4 MHz. Directive antennas shall be employed above 4 MHz unless they are shown to be impracticable in specific cases.

b. Minimum forward power gain over an isotropic radiator located at the same height over the same Earth as directive antenna shall be 10 dB in the range 4 to 10 MHz and 15 dB in the range 10 to 30 MHz<sup>4</sup>. The gain of any

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<sup>1</sup> In other than exceptional cases the practice is to authorize 3 kHz as the necessary bandwidth for normal voice intelligibility. This is specified by the emission designator. In the practical case, to meet the minimum performance requirements of this paragraph the roll-off of the emission curve will begin at a value somewhat less than 1.5 kHz from the assigned frequency.

<sup>2</sup> Passband--The passband is the band of frequencies limited by the two frequencies for which the voltage is attenuated to one-half of the voltage of the most favored frequency.

<sup>3</sup> Applies to both transmitting and receiving antennas, but to the latter only when protection from harmful interference is required.

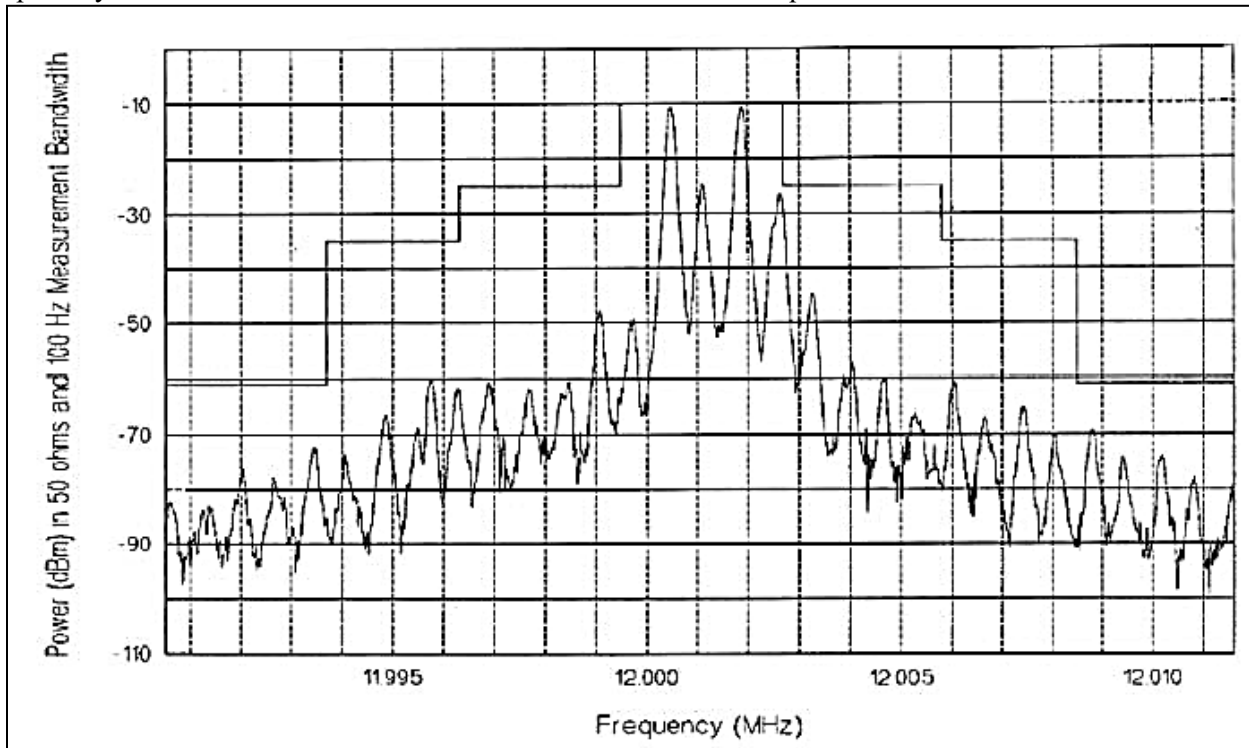
<sup>4</sup> These gain figures would be approximately 6 dB greater if the gain were to be expressed relative to an isotropic antenna in free

reference antenna used in an actual measurement must be specified relative to an isotropic antenna.

c. The antenna gain in the desired direction over that of a lobe in any other direction shall be greater than 6 dB.

## 2. Mobile Station

To the extent practicable, land stations shall use antennas designed so as to reduce their radiation and/or their susceptibility to interference in those directions where service is not required.



**Figure 5.3.1**

**RSL (dBm) vs. Frequency (MHz)**

**Example of Measured Emission for HF SSB Transmitter Fundamental with NTIA Standard in Section 5.3.1.**

**Modulation Tones = 400 Hz and 1800 Hz, Resolution BW = 100 Hz, Span = 21.1 kHz**

### 5.3.2 Maritime Mobile Stations Using FM (150.8-162.0125 MHz)

1. This standard is for maritime mobile stations using FM emissions in the band 150.8-162.0125 MHz with a necessary bandwidth of less than or equal to 16 kHz.

2. After January 21, 1997, ship station transmitters, except portable ship station transmitter, must be capable of automatically reducing power to 1 watt or less when tuned to the frequency 156.375 MHz or 156.650 MHz. A manual override will permit full carrier power operation on these channels.

### 5.3.3 Fixed Services (406.1-420 MHz Band, the 932-935/941-944 MHz Bands, the 1780 MHz-15.35 GHz, the 21.8-22.075 GHz and 23-23.275 GHz Frequency Ranges)

The following standard is for Federal Government fixed services employing: (a) multichannel equipment in the 406.1-420 MHz band, (b) point-to-point and point-to-multipoint equipment in the bands 932-935/941-944 MHz, (c) point-to-point and transportable type equipment operating between 1710 MHz and 15.35 GHz (except for systems designed to use scatter techniques), or (d) point-to-point type equipment operating between 21.8-22.075 GHz and 23-23.275 GHz.

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space, in order to account for ground reflection.

### 5.3.3.1 Transmitter Standards

1. Unwanted Emissions. The mean power of any emission on any frequency removed from the center of the authorized bandwidth (BW) by a displacement frequency ( $f_d$  in kHz) shall be attenuated below the mean output power (pY) of the transmitter in accordance with the following schedule. For cases where a resolution bandwidth is not specified, use 100 kHz for center frequencies less than 1 GHz and 1 MHz for center frequencies greater than or equal to 1 GHz:

a. For transmission other than those employing digital modulation techniques:

<b><math>f_d</math> in kHz</b>	<b>Attenuation in dB</b>
$50\%BW < f_d \leq 100\%BW$	25
$100\%BW < f_d \leq 250\%BW$	35
$f_d > 250\% BW$	$43 + 10\log(pY)$ or 80 whichever is the lesser attenuation

(see Figure 5.3.3.a for a sample application of this standard)

b. For transmissions employing digital modulation techniques:<sup>5</sup>

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent, up to and including 250 percent, of the authorized bandwidth as specified by the following equation but at least 50 decibels:

$$A = 35 + .8(\% - 50) + 10\log(BW)$$

where:

A = attenuation (in decibels) below the mean output power level, % = percent of the authorized bandwidth removed from the assigned frequency.

and:

BW = authorized bandwidth in MHz.

Attenuation greater than 80 decibels or an absolute power of less than -13/dBm/MHz is not required.

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log(pY)$  decibels, or 80 decibels, whichever is the lesser attenuation. The Measurement Method is in paragraph M.2.1.3.1.(b) of Annex M. (see Figure 5.3.3b for a sample application of this standard) c. In the bands 932-935 and 941-944 MHz, fixed point-to-multipoint stations using transmissions employing digital modulation techniques with a bandwidth of 12.5 kHz or less, the power of any emission shall be attenuated below the unmodulated carrier power (mean power can be used) of the transmitter (pY) in accordance with the following schedule:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 2.5 kHz up to and including 6.25 kHz: At least  $53 \log(f_d/2.5)$  decibels;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 6.25 kHz up to and including 9.5 kHz: At least  $103 \log(f_d/3.9)$  decibels;
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 9.5 kHz up to and including 15 kHz: At least  $157 \log(f_d/5.3)$  decibels;
- (4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency

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<sup>5</sup> Relatively narrowband digital radio systems may be unduly restricted by this standard. Work is in progress to define appropriate limitations for such narrowband systems. This standard will be modified in accordance with the findings and experience with such narrowband systems.



greater than 15 kHz: At least  $50 + 10 \log(pY)$  or 70 decibels, whichever is the lesser attenuation.

d. In the bands 932-935 and 941-944 MHz, fixed point-to-multipoint stations using transmissions employing digital modulation techniques with a bandwidth greater than 12.5 kHz, the power of any emission shall be attenuated below the unmodulated carrier power (mean power can be used) (pY) of the transmitter in accordance with the following schedule;

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz up to and including 10 kHz: At least  $83 \log (fd/5)$  decibels;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz up to and including 250 percent of the authorized bandwidth: At least  $116 \log (fd/6.1)$  or  $50 + 10 \log(pY)$  or 70 decibels, whichever is the lesser attenuation;

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log(pY)$  decibels or 80 decibels, whichever is the lesser attenuation.

2. The maximum equivalent isotropic radiated power (EIRP) shall not exceed the values specified below. However, the additional constraints of Section 8.2.34 of this manual apply.

Frequency Band (MHz)	Maximum Allowable EIRP (dBm)
406.1-420	80
932-932.5	47
932.5-935	70
941-941.5	60
941.5-944	70
1780-1850	80
2200-2290	For Path Length of Less than 25 km: $80 - 40 \cdot \log (25/\text{Path Length in km})$ For Path Length of Greater than 25km: 80
4400-4940	For Path Length of Less than 25 km: $80 - 40 \cdot \log (25/\text{Path Length in km})$ For Path Length of Greater than 25km: 80
7125-8500	For Path Length of Less than 25 km: $80 - 40 \cdot \log (25/\text{Path Length in km})$ For Path Length of Greater than 25km: 80
14400-15350	85
21800-22075	85
23000-23275	85
The effective date for the new EIRP limits is January 1, 2013. All existing systems will be grandfathered under the current EIRP limits.	

- (a) Federal agencies shall be granted an exemption to the EIRP limits in this table if an appropriate technical rationale is provided. Federal agencies using microwave links to safeguard property and lives will be afforded additional considerations by the NTIA committees to ensure that integrity of those microwave links are not negatively impacted by reduction of the EIRP limits.
- (b) Transmitters shall use automatic transmitter power control (ATPC) where feasible. The EIRP of a fixed microwave system using ATPC shall not exceed the authorized limit. The effective date for use of ATPC is July 31, 2017. All existing systems will be grandfathered prior to the effective date.

### 5.3.3.2 Receiver Standards

1. The receiver unwanted signals shall be attenuated at least 60 dB relative to the receiver sensitivity at the center of the passband. The Measurement Method is in paragraph M.2.1.3.2.(b) of Annex M.
2. Selectivity. Receiver selectivity is the degree to which a receiver is able to discriminate against the effects of undesired signals primarily outside the authorized emission bandwidth that arrive at its RF input terminals.  
The -3 dB receiver bandwidth should be commensurate with the authorized emission bandwidth plus twice the frequency tolerance of the transmitter specified in Section 5.2.1. The -60 dB receiver bandwidth shall not exceed five times the -3 dB receiver bandwidth.
3. Conducted Undesired Emissions are those undesired signals generated in the receiver and leaving the receiver by way of the receiving transmission line.
4. Conducted emissions from the receiver on any frequency, as measured at the radio frequency interface point to the antenna system, shall not exceed -85 dBW. For the bands 406.1-420 MHz and 932-935/941-944 MHz, conducted emissions shall not exceed -57 dB.
5. Noise Figure. The noise figure of a receiver is the ratio expressed in dB of (1) the output noise power to (2) the portion of noise power attributable to thermal noise in the input termination at 290 kelvins.
6. The receiver noise figure including preamplifier should be 9 dB or less for frequencies below 4400 MHz, 12 dB or less for frequencies between 4400 MHz, and 10 GHz, and 14 dB or less for higher frequencies (up to 15.35 GHz).

### 5.3.3.3 Antenna Standards

- The following limitations do not apply to transportable antenna systems when used in tactical and training operations. Additionally, the following limitations do not apply to multipoint distribution systems (point-to-multipoint) operating in the bands 406.1-420, 932-932.5 and 941-941.5 MHz.
- a. Each station shall employ directional antennas with the major lobe of radiation directed toward the receiving station with which it communicates, or toward any passive repeater that may be used.
  - b. Antenna Radiation Pattern. The antenna radiation pattern is the relative power gain as a function of direction for the specified polarization.
  - c. Directional antennas shall meet the performance standards indicated in Table 5.3.3, Table 5.3.4 and Table 5.3.5. For assignments in bands shared with satellite-space services, determination on additional beamwidth limitations shall be made on a case-by-case basis if mutual interference problems are likely to be involved.

**Table 5.3.3**

Frequency Band	Maximum Half Power Beamwidth (3 dB point)	Minimum Suppression at Angle in degrees off Mainbeam Axis (dB)						
		5-10	10-15	15-20	20-30	30-100	100-140	140-180
406.1-420 MHz <sup>1</sup>	80	-	-	-	-	10	10	10
a) 932.5-935 MHz 941.5-944 MHz <sup>2</sup>	14	-	6	11	14	17	20	24
b) 932.5-935 MHz 941.5-944 MHz <sup>2</sup>	20	-	-	6	10	13	15	20
1710-1850 MHz <sup>3</sup>	10	-	14	16	18	23	24	30
1710-1850 MHz <sup>4</sup>	8	5	18	20	20	25	28	36
2200-2400 MHz	8.5	4	12	16	16	24	25	30
14.4-15.35 GHz	1.5	21	26	31	35	37	41	48
21.8 – 22.075 GHz and 23 -23.275 GHz	3.3	18	26	26	33	33	55	55

1 - Any secondary lobe.

2 - Stations in this service must employ an antenna that meets the performance standard except that, in areas not subject to frequency congestion, subject to frequency coordination along the borders of the U.S., antennas meeting standards for category B may be employed. Note, however, the use of a high performance antenna may be required where interference problems can be resolved by the use of such antennas.

3 - These suppression levels could be met, e.g., by a 1.2 meter (4 foot) diameter parabolic antenna.

4 - This standard is applicable to stations in the 1710-1850 MHz band placed in service after January 1, 1985, except for those located on the military test ranges specified in Section 7.17.1 and those limitations noted in paragraph 5.3.3.3. These suppression levels could be met, e.g., by a 1.83 meter (6 foot) diameter parabolic antenna.

**Table 5.3.4**

Frequency Band	Category	Maximum Half Power Beamwidth (3dB Point)	Minimum Suppression at Angle in degrees Off Mainbeam Axis (dB)						
			5-10	10-15	15-20	20-30	30-100	100-140	140-180
4.4-4.94 GHz	A	4	13	20	23	24	29	31	31
	B1	7.5	5	15	22	24	27	29	31
	B2	14	5-10	10-15	15-30	30-60	60-100	100-140	140-180
			1.3	5	10	15	20	29	31

Notes:

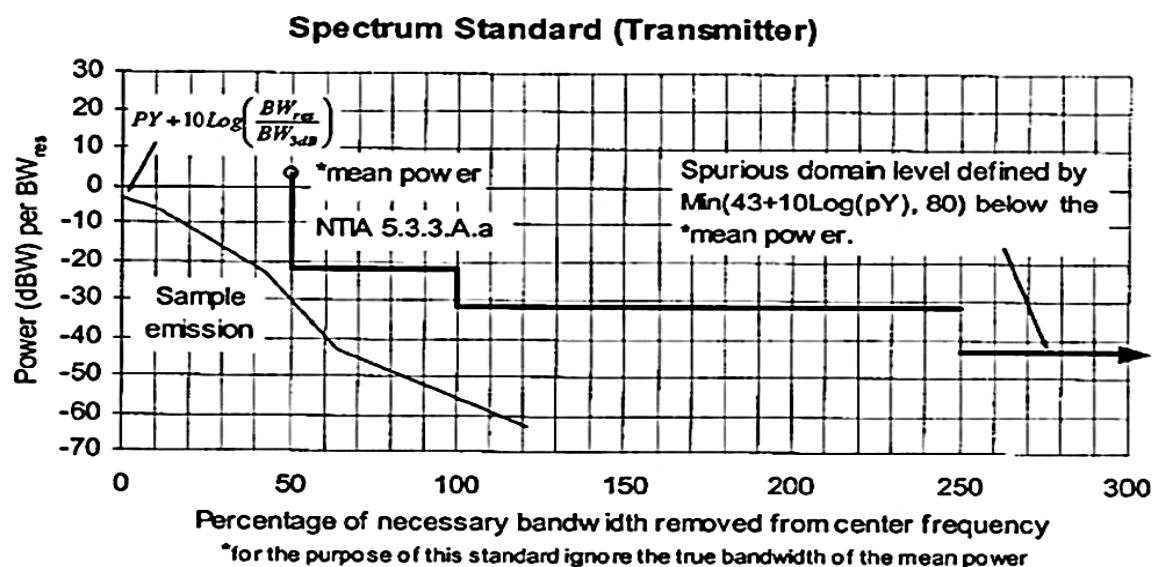
- There are three categories of antenna standards in the 4.4-4.94 GHz band:  
Category A: Applicable to all antennas.  
Category B1: Applicable to parabolic antennas with a diameter of less than 1.2 meters (4 foot).  
Category B2: Applicable to flat panel antennas.
- The use of high performance standard antennas is required where interference problems occur.
- The new standard is applicable to antennas procured after January 1, 2017. Antenna systems that have been procured prior to January 1, 2017 will be "grandfathered" under the new rules.

**Table 5.3.5**

Frequency Band	Category	Maximum Half Power Beamwidth (3dB point)	Minimum Suppression at Angle in degrees off Mainbeam Axis (dB)						
			5-10	10-15	15-20	20-30	30-100	100-140	140-180
7.125-8.5 GHz	A	2.5	19	23	28	30	34	35	43
	B	4.7	11	17	21	23	27	51	51

Notes:

1. There are two categories of antenna standards in the 7.125-8.5 GHz band:  
Category A: Applicable to all antennas in the band.
2. Category B: Applicable to parabolic dish antennas with a diameter of less than 1.2 meters (4 foot). The use of high performance standard antennas is required where interference problems occur.
3. The new standard is applicable to antennas procured after July 1, 2018. Antenna systems procured and approved by NTIA prior to July 1, 2018 will be "grandfathered" under the new rules.



**Figure 5.3.3a**

Figure 5.3.3a shows a sample analog emission whose center frequency is 7.135 GHz, necessary bandwidth is 19.8 MHz, -3 dB bandwidth is 4 MHz, and mean output is 2 watts (3 dBW), plotted against the standard. The emission complies with the standard.

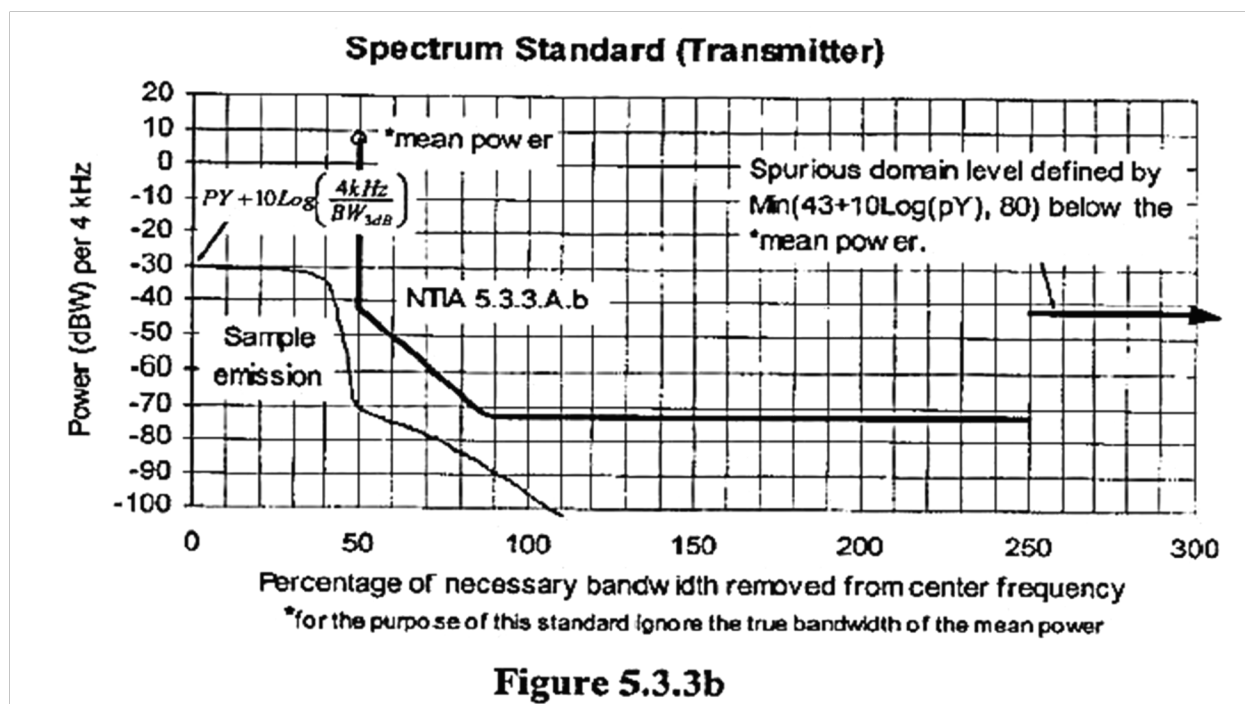


Figure 5.3.3b shows a sample digital emission whose necessary bandwidth is 30 MHz, -3 dB bandwidth is 22 MHz, and mean output power is 5 watts (7 dBW), plotted against the standard. The emission complies with the standard.

Note: It is recognized that relatively narrowband systems may be unduly restricted by this standard. Work is in progress to define appropriate limitations for such narrowband systems. This standard will be modified in accordance with findings and experience with such narrowband systems.

#### 5.3.3.4 Interference Analysis Methodology for Frequency Coordination

1. Fixed microwave systems shall apply interference analysis methodology specified in the Telecommunication Industry Association's Telecommunications Systems Bulletin TSB - 10F (TSB - 10F) for frequency coordination or established engineering practices.

2. Fixed microwave systems that operate ATPC in the bands of 1780-1850 MHz, 2200-2290 MHz, 4400-4940 MHz, and 7125-8500 MHz, nominal transmit power, ATPC trigger level, and coordinated transmit power shall be provided for frequency assignment.

#### 5.3.3.5 Spectrum Efficiency Standards

For all Fixed Service bands in Section 5.3.3 with the exception of three bands shown in the Table below, the bit rate (in bits per second) of digital microwave transmitters must be equal to or greater than the bandwidth specified by the emission designator in Hertz.

For the following bands, the minimum efficiency standards for the payload capacity of digital equipment apply:

Frequency	Emission bandwidth ≤5 MHz	Emission bandwidth >5 MHz and ≤20 MHz	Emission bandwidth >20 MHz
4400-4940 MHz	2.4 bits/second/Hertz	4.4 bits/second/Hertz	4.4 bits/second/Hertz
7125-8500 MHz	2.4 bits/second/Hertz	4.4 bits/second/Hertz	4.4 bits/second/Hertz
14.4-15.35 GHz	2.4 bits/second/Hertz	4.4 bits/second/Hertz	3.0 bits/second/Hertz

Traffic loading payload shall exceed 50 percent of payload capacity within 60 months of obtaining a frequency authorization. Fixed Service links must comply with the capacity and loading requirements that use digital equipment capable of adjusting modulation and must be designed using generally accepted multipath fading and rain fading models to meet the specified capacity and loading requirements at least 99.95 percent of the time, in the aggregate for both directions in a two-way link.

The effective date is January 1, 2021. A waiver request may be submitted in accordance with Section 10.1.3 (and/or Section 5.1.2 if relevant) or Section 8.2.6, providing a justification that should include a narrative and relevant technical information for evaluation. Existing Fixed Service systems will be grandfathered. Fixed service systems used for backup and frequency diversity are exempted from the traffic-loading requirement.<sup>6</sup>

### 5.3.4 Land Mobile, Single Channel Narrowband Operations (220-222 MHz Band)

The 220-222 MHz band was reallocated on September 6, 1988 to the land mobile service for shared federal and non-federal operations. The operations are limited to single channel, narrowband equipment. The 2 MHz available in this band are allocated in 400 channels each 5 kHz wide and paired to create 200 narrowband channel pairs. See Section 4.3.15 for the channeling plan. This standard became effective on January 1, 1992.

#### 5.3.4.1 Transmitter Standards

1. Bandwidth Limitations: The maximum authorized bandwidth shall be 4 kHz.
2. Unwanted Emissions: On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz), the power of any emission shall be attenuated below the peak envelope power (pX) watts in accordance with the following schedule:

$f_d$ in kHz		Attenuation in dB
	the	$30 + 20(f_d - 2)$ or
$2 < f_d \leq 3.75$	lesser	$55 + 10\log(pX)$ or
	of	65
$3.75 < f_d$	at least	$55 + 10\log(pX)$

The Measurement Method is in paragraph M.2.1.4 of Annex M.

#### 5.3.4.2 Geographic Separation of Sub-Band A Base Station Receivers and Sub-Band B Base Station Transmitters

1. Base station receivers utilizing channels assigned for sub-band A as designated in Chapter 4 will be geographically separated from those base station transmitters utilizing channels removed 200 kHz or less and assigned from sub-band B as follows:

Separation Distances (Kilometers)	Effective Radiated Power (Watts)*
0.0 - 0.3	**
0.3 - 0.5	5
0.5 - 0.6	10
0.6 - 0.8	20
0.8 - 2.0	25
2.0 - 4.0	50
4.0 - 5.0	100
5.0 - 6.0	200
over 6.0	500

\* Transmitter peak envelope power shall be used to determine effective radiated power.

<sup>6</sup> Frequency diversity is the process of receiving a radio signal on multiple frequencies to reduce the effects of radio signal distortions (such as multipath fading) that occur on one frequency but do not occur on another frequency. A backup microwave system is a redundant system, and only becomes operational when the primary system is down.

\*\* Stations separated by 0.3 km or less shall not be authorized. This table does not apply to the low-power mobile data channels 196-200. (See Section 5.3.4.3)

2. Except for nationwide assignments, the separation of co-channel base stations shall be 120 kilometers. Shorter separations will be considered on a case-by-case basis upon submission of a technical analysis indicating that at least a 10 dB protection will be provided to an existing station's 39 dB  $\mu$  signal level contour.

### 5.3.4.3 Limitations on Power and Antenna Height:

1. The permissible effective radiated power (ERP) with respect to antenna heights shall be determined from the following table. These are maximum values and applications are required to justify power levels requested.

<b>Table. ERP vs. Antenna Height</b>	
<b>Antenna Height above Average Terrain (HAAT) Meters</b>	<b>Effective Radiated Power (ERP) Watts*</b>
Up to 150	500
150 to 225	250
225 to 300	125
300 to 450	60
450 to 600	30
600 to 750	20
750 to 900	15
900 to 1050	10
Above 1050	5

\* Transmitter PEP shall be used to determine ERP.

2. The maximum permissible ERP for mobile units is 50 watts. Portable units are considered as mobile units.

3. Channels 196-200 are limited to 2 watts ERP and a maximum antenna height of 6.1 meters (20 feet) above ground.

### 5.3.5 Standards for Fixed and Mobile Analog or Digital FM/PM Operations (29.7-50, 138-150.8, 162-174, and 406.1-420 MHz Bands)<sup>7</sup>

### 5.3.6 Standard for Fixed and Mobile Analog or Digital FM/PM Wideband Operations (29.7-50, 162-174, and 406.1-420 MHz Bands)

1. Standards in this section related specifically to digital systems became effective on October 1, 1990.

2. These standards do not apply to:

- Military equipment used for tactical and/or training operations.
- FM wireless microphone systems whose mean output power does not exceed 0.1 watt.
- Equipment operating on splinter channels. (see Section 5.3.8).
- Fixed stations equipment with multichannel emissions (see Section 5.3.3).

3. The following is for fixed and mobile/land mobile service employing fixed, land, mobile and portable stations using analog or digital FM or PM emissions in the bands 29.7-50, 162-174, and 406.1-420 MHz. These standards are based upon emissions with analog input and a necessary bandwidth of 16 kHz.<sup>8</sup>

Stations with digital input may require a different necessary bandwidth but still must meet all other standards.

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<sup>7</sup> In the band 406.1 - 410 MHz, power is limited to a maximum of 7 W/kHz of necessary bandwidth as specified in footnote US117 to the Tables of Frequency Allocations (Chapter 4).

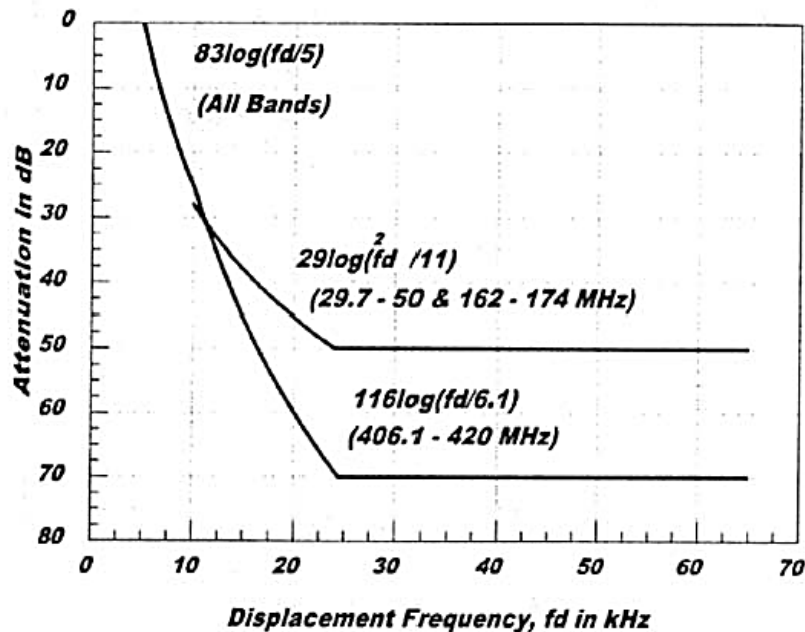
<sup>8</sup> The spacing of channels (adjacent channel spacing) is 20 kHz in the 30-50 MHz band and 12.5 kHz in the 162-174 and 406.1-420 MHz bands.

### 5.3.6.1 Transmitter

1. Unwanted Emissions: The power of any unwanted emission on any frequency removed from the center of the authorized bandwidth (BW) by a displacement frequency ( $f_d$  in kHz) shall be attenuated below the unmodulated carrier power (pZ) in accordance with the following and Figure 5.3.6.1.

$f_d$ in kHz	Attenuation in dB
$5 \text{ kHz} < f_d \leq 10 \text{ kHz}$	All bands: $83\log(f_d/5)$
$10 \text{ kHz} < f_d \leq 250\% \text{ BW}$	29.7-50 MHz & 162-174 MHz: $29\log(f_d^2/11)$ or 50 whichever is the lesser attenuation

Figure 5.3.6.1



406.1-420 MHz:  $116\log(f_d/6.1)$  or  $50 + 10\log(pZ)$  or 70 whichever is the lesser attenuation.

$f_d > 250\% \text{ BW}$	All bands: $50 + 10\log(pZ)$ (i.e. 10 microwatts absolute) Portable $43 + 10\log(pZ)$ (i.e. 50 microwatts absolute)
--------------------------	------------------------------------------------------------------------------------------------------------------------

Figure 5.3.6.1 shows the mask for a fixed or mobile station operating in the bands 29.7-50, 162-174 and 406.1-420 MHz with an authorized bandwidth of 25 kHz and a mean power of 100 watts.

2. Frequency deviation for all station classes and frequency bands shall not exceed 5 kHz. The Measurement Method is in paragraph M.2.1.5.1 of Annex M.

### 5.3.6.2 Receiver

1. Spurious Response Attenuation:

Station Class	Band (MHz)		
	29.7-50	162-174	406.1-420
Land, Fixed, Mobile	85 dB	85 dB	85 dB
Portable	60 dB	60 dB	50 dB

2. Adjacent Channel Selectivity:

ANALOG	
Station Class	Band (MHz)



	29.7-50	162-174	406.1-420
Land, Fixed, Mobile	80 dB	80 dB	80 dB
Portable	50 dB	70 dB	60 dB

DIGITAL			
Station Class	Band (MHz)		
	29.7-50	162-174	406.1-420
Land, Fixed, Mobile	50 dB	55 dB	55 dB
Portable	50 dB	50 dB	50 dB

### 3. Intermodulation Attenuation:

Station Class	Band (MHz)		
	29.7-50	162-174	406.1-420
Land, Fixed, Mobile	60 dB	70 dB	70 dB
Portable	50 dB	50 dB	50 dB

4. Conducted Spurious Emissions: All station classes and all bands -57 dBm.

5. The Measurement Method is in paragraph M.2.1.5.1 of Annex M.

## 5.3.7 Standards for Fixed and Mobile Analog or Digital FM/PM Narrowband Operations in the 138-150.8, 162-174 and 406.1-420 MHz Bands

The standards outlined in this section apply to narrowband systems in the 138-150.8, 162-174 and 406.1-420 MHz bands. These standards do not apply to:

- Military equipment used for tactical and/or training operations in the 138-150.8 MHz band.
- FM wireless microphone systems whose mean output power does not exceed 0.1 watt.
- Equipment operating on channels designated for low-power systems as set forth in Sections 4.3.8, and 5.3.8.
- NOAA Weather Radio Transmitters.

### 5.3.7.1 Standards

The following standards apply to fixed and mobile/land mobile services employing fixed, land, mobile, and portable stations using analog or digital emissions in the 138-150.8, 162-174 and 406.1-420 MHz bands with a necessary bandwidth of 11 kHz or less. These standards are based upon either TIA/EIA 603-C for narrowband analog or TIA-102.CAAB-B for narrowband digital transmitters and receivers. Additionally, the receiver standards listed below are based upon Class A receiver limits as specified in the appropriate TIA publication.

### 5.3.7.2 Effective Dates

These standards for new narrowband stations operating within the subject frequency bands shall become effective on 1 January 2008. Stations already operational, procured prior to 1 January 2008 or have been approved by NTIA/SPS will be allowed to operate in accordance with existing standards and without modification until the end of the lifecycle of the equipment.

### 5.3.7.3 Waivers

Waivers of the requirements herein may be requested when supported by reasonable justification. Waiver requests should be accompanied by technical data in support of the waiver and an explanation of the non-conforming parameters. Waivers granted will be subject to the provisions of Section 5.1.2.

#### A. Transmitter

Unwanted Emissions: The power of any unwanted emission on any frequency removed from the center of the

authorized bandwidth (BW) by a displacement frequency ( $f_d$ ) shall be attenuated below the unmodulated carrier power (pZ) in accordance with the following and the emission mask in Figure 5.3.7.1.

Displacement Freq ( $f_d$ )	Attenuation (dB)
$0 < f_d \leq 2.5$ kHz	0
$2.5$ kHz $< f_d < 12.5$ kHz	$7(f_d - 2.5)$
$12.5$ kHz $< f_d$	$50 + 10\log(\text{pZ})$ or 70 whichever is the smaller

2. Frequency deviation for all FM or PM station classes shall not exceed 2.5 kHz for analog emissions, and 3.11 kHz for digital emissions
3. The Measurement Method is in paragraph M.2.1.5.2 of Annex M.

## B. Receiver

1. Spurious Response Attenuation (all bands):

Station Class	Digital	Analog
Land, Fixed	90 dB	75 dB
Mobile	80 dB	75 dB
Portable	70 dB	70 dB

2. Adjacent Channel Selectivity (all bands):

Station Class	Digital	Analog
Land, Fixed	60 dB	45 dB
Mobile	60 dB	45 dB
Portable	60 dB	45 dB

3. Intermodulation Rejection (all bands):

Station Class	Digital	Analog
Land, Fixed	80 dB	75 dB
Mobile	75 dB	75 dB
Portable	70 dB	70 dB

4. Conducted Spurious Emissions for all station classes and all bands: -57 dBm.

5. The Measurement Method is in paragraph M.2.1.5.2 of Annex M.

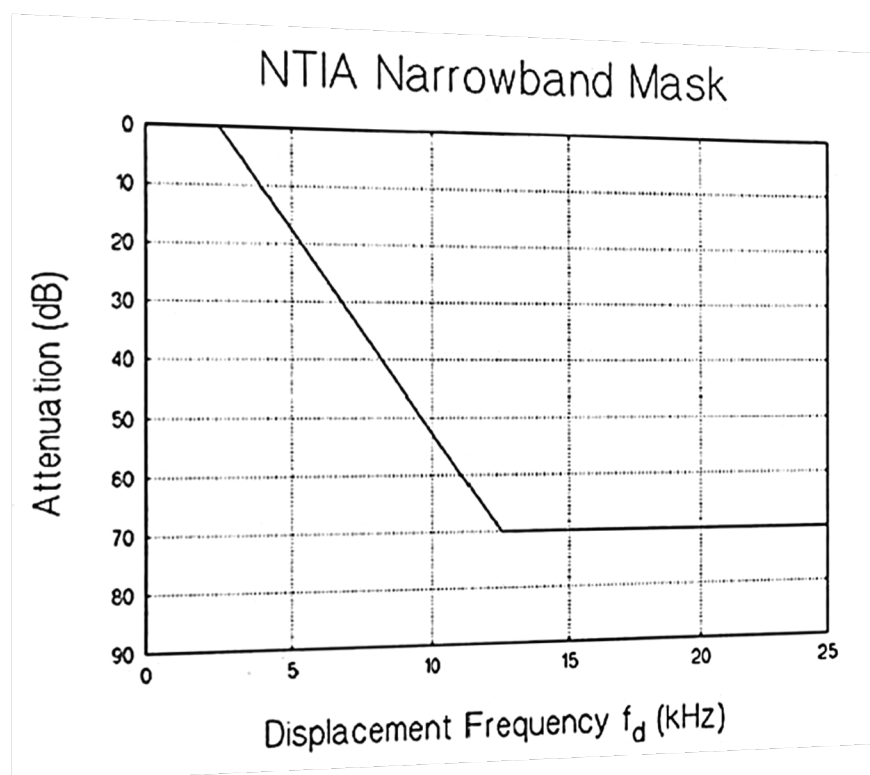


Figure 5.3.7.1

## LEVELS OF UNWANTED EMISSIONS

Note: This emission mask represents the Telecommunications Industry Association (TIA) emission mask developed for narrowband FM and Digital systems designed to operate in 12.5 kHz channels in the 138-150.8 MHz, 162-174 MHz, and 406.1-420 MHz bands. (The mask assumes  $pZ=100$  watts.)

### 5.3.8 Low Power Channels and Splitter Channels (162-174 MHz Band)

1. The following transmitter standards are for the use of fixed and mobile low power channels identified in Section 4.3.8.

2. Emission--For FM or PM emission the maximum frequency deviation plus the highest audio tone shall not exceed 0.5 times the authorized bandwidth (authorized bandwidth is equal to  $2D + 2M$ ).

3. Unwanted emission levels at the equipment antenna terminals on any frequency removed from the center of the authorized bandwidth (BW) by a displacement frequency ( $f_d$  in kHz) shall be attenuated below the mean power (pY) of the unmodulated carrier output as specified by the following:

$f_d$ in kHz	Attenuation in dB
$50\%BW < f_d \leq 100\% BW$	25
$100\%BW < f_d \leq 250\% BW$	35
$f_d > 250\% BW$	$43 \text{ dB} + 10 \log (pY)$

4. Power output--The maximum mean power of the unmodulated carrier output for operations on splitter channels in the 406.1-420 MHz band shall be limited to 30 watts.

### 5.3.9 Telemetry, Terrestrial (1435-1525, 2200-2290, 2310-2320, 2345-2395, 4400-4940, and 5091-5150 MHz Bands)

This standard is applicable to terrestrial telemetering stations, authorized for operation in the bands 1435-1525,

2200-2290, 2310-2320, 2345-2395, 4400-4940, and 5091-5150 MHz. The details of this standard can be found in Chapter 2 of the Range Commanders Council Telemetry IRIG Standard TG 106-## Part 1. This document can be found at <http://www.irig106.org/docs/106-15/>. Subsequent revisions of this document will be reviewed by the Technical Subcommittee prior to adoption.

### 5.3.10 Low Power Transmit (21.8-22.075 and 23.0-23.275 GHz Band Segments)<sup>9</sup>

1. These standards apply to the following six frequency pairs within the above two band segments:

21.825 GHz	23.025 GHz
21.875 GHz	23.075 GHz
21.925 GHz	23.125 GHz
21.975 GHz	23.175 GHz
22.025 GHz	23.225 GHz
22.075 GHz	23.275 GHz

2. **Unwanted Emissions.** When using transmissions other than those employing digital modulation techniques: the mean power of any emission supplied to the antenna transmission line, as compared with the mean power of the fundamental, shall be in accordance with the following (above 40 GHz these are design objectives pending further experience at these orders of frequency):

- a. On any frequency removed from the assigned frequency by more than 50 percent, up to and including 100 percent of the authorized bandwidth, at least 25 decibels attenuation;

- b. On any frequency removed from the assigned frequency by more than 100 percent, up to and including 250 percent of the authorized bandwidth, at least 35 decibels attenuation; and

- c. On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth, at least  $43 + 10 \log(pY)$  decibels or 80 decibels, whichever is the lesser attenuation.

2. Maximum equivalent isotropically radiated power (EIRP) shall be 55 dBm.

3. The rated transmitter output power shall not exceed 0.100 watts.

4. Upon showing need, a maximum bandwidth of 50 MHz may be authorized per frequency assigned.

5. These radio systems shall have no more than five hops in tandem, except upon showing of need, but in any event the maximum tandem length shall not exceed 40 km (25 miles).

6. Interfering signals at the antenna terminals of stations authorized shall not exceed -90 dBm and -70 dBm, respectively, for co-channel and adjacent channel interfering signals.

7. Antennas employing circular polarization may be used with these systems.

8. Maximum beamwidth shall not exceed 4 degrees with a minimum front-to-back ratio of 38 dB.

### 5.3.11 Standard for Fixed and Mobile Digital 6.25 kHz Channel Equipment in the 162-174 MHz and 406.1-420 MHz Band

The standards outlined in this section applies to land mobile radio equipment employing a 6.25 kHz channel in the 162-174 MHz and 406.1-420 MHz band.

#### 5.3.11.1 Standards

The following standards apply to fixed and mobile/land mobile services employing fixed, land, mobile, and portable stations using 6.25 kHz channels in the 162-174 MHz and 406.1-420 MHz band. The transmitter standard is based upon the FCC emission mask for 6.25 kHz or less channel bandwidth equipment specified in 47 C.F.R. Section 90.210(e)(1)-(3). The receiver standard is based upon Class A receiver limits as specified in the appropriate TIA publication.

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<sup>9</sup> These frequency pairs are shared between federal and non-federal users. Power constraints placed on the frequency pairs facilitate coordination due to the decreased interference potential.

### 5.3.11.2 Effective Dates

These standards for fixed, land, mobile, and portable stations using 6.25 kHz channels in the subject frequency band shall become effective on February 1, 2016.

### 5.3.11.3 Waivers

Waivers of this standard is not necessary.

#### A. Transmitter

1. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) in watts of the highest emission contained within the authorized bandwidth as follows:

- a. On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- b. On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- c. On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.

2. The Measurement Method is in paragraph M.2.1.5.3 of Annex M.

#### B. Receiver

1. Spurious Response Attenuation:

Station Class	Digital
Land, Fixed	90 dB
Mobile	80 dB
Portable	70 dB

2. Adjacent Channel Selectivity:

Station Class	Digital
Land, Fixed	60 dB
Mobile	60 dB
Portable	60 dB

3. Intermodulation Rejection:

Station Class	Digital
Land, Fixed	80 dB
Mobile	75 dB
Portable	70 dB

4. Conducted Spurious Emissions for all station classes is: -57 dBm.

5. The Measurement Method is in paragraph M.2.1.5.3 of Annex M.

## 5.4 DISTRESS AND SAFETY COMMUNICATIONS

1. Global Maritime Distress and Safety System (GMDSS):

Stations in the maritime and other radio services employing frequencies and techniques used in the GMDSS shall comply with the relevant ITU-R recommendations with respect to the technical characteristics of:

- a. Digital selective calling (DSC) distress call formats (RR 32.9.3 and 34.2);

- b. DSC on VHF channel 70 (156.525 MHz):
    - (1) Capability of sensing the presence of a signal on channel 70, and
    - (2) Automatic prevention of transmitting a DSC call on channel 70, except for a distress and safety call by DSC, when the channel is occupied by calls (Volume 4, Rec. ITU-R M.489-2);
  - c. Other aspects of DSC equipment (RR 54.2);
  - d. Narrowband direct printing (NBDP) message formats (Volume 4, Rec. ITU-R M.492-6) and error correction for distress, urgency, and safety messages (RR 32.43, 33.17, and 33.37, respectively);
  - e. Transmissions from satellite emergency position-indicating radio beacons (EPIRBs) operating in the bands 406-406.1 MHz and 1645.5-1646.5 MHz (RR Appendix 13 Part A5, Section I(c) and RR 34.1);
  - f. Transmissions from search and rescue radar transponders operating in the band 9200-9500 MHz (RR 5.474);
- and
- g. Broadcasts on 518 (NAVTEX) and other broadcasts of maritime safety information using NBDP in the bands 4-27.5 MHz (RR 33.41).

Additionally, such stations when using DSC shall conform to the calling, acknowledgement, and operating procedures for DSC contained in the Radio Regulations (Article 32) and the relevant ITU-R recommendation(s).

#### 2. 121.5/243 MHz EPIRBs:

EPIRBs operating at 121.5 MHz and/or 243 MHz shall conform to the requirements of Volume 4, Rec. ITU-R M.690-3 and Annex 10 to the Convention on International Civil Aviation, to the extent that each provision is applicable.

## 5.5 RADAR SPECTRUM ENGINEERING CRITERIA (RSEC)

### 5.5.1 General

1. The wide application of radar for various functions makes large demands on the electromagnetic spectrum, and requires the application of effective frequency management measures for the equipment and systems involved. Criteria for certain equipment characteristics are specified herein to ensure an acceptable degree of electromagnetic compatibility among radar systems, and between such systems and those of other radio services sharing the frequency spectrum. Agencies typically submit the necessary information on the radar system to NTIA via the EL-CID so that NTIA can perform a system review of the radar system, to see if it adheres to the NTIA RSEC standards and criteria contained in this section. The criteria, and their standards, were developed by NTIA and the federal agencies with the realization that many different types of radars operate in frequency bands allocated to the radiodetermination service.

2. These criteria are concerned with promoting effective use of the spectrum, and in specifying them there is no intent to require particular numerical values from the standpoint of the radar's mission. For example, characteristics such as power, sensitivity, pulse repetition rate, pulse duration, pulse rise and fall times, and the range of radio frequency emissions are closely related to. Accordingly, where limits for some of these characteristics are specified herein, the criteria have been chosen to avoid undue degradation of operational effectiveness. Moreover, the specification of these criteria is compatible with the policy of encouraging a free and unrestricted approach in further research looking toward more effective radars. Nevertheless, any proposals for new approaches and new system concepts involving radars must be reviewed from a frequency management viewpoint prior to development of new equipment.

3. Useful receiver techniques are available for reduction of the susceptibility of radars to low-duty-cycle pulsed interference. The applicability of such devices as video integrators, correlators, pulse repetition rate and pulse width discriminators varies with factors such as cost, availability, and their adaptability to specific equipment and environmental situations. While the mandatory incorporation of such devices is not specified herein, their application is recommended for low duty-cycle radars intended for operation in congested frequency bands and geographic areas.

4. All primary radars shall be classified in one of five groups as shown in the following table and shall come under the criteria indicated for that group.<sup>10</sup> They are identified as RSEC Criteria A, B, C, D, and E. The method to

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<sup>10</sup> Primary Radar: A radiodetermination system based on the comparison of reference signals with radio signals reflected from the position to be determined. (No. 1.101 of the ITU Radio Regulations, 2015 Edition.)

determine which criteria a primary radar is grouped within for each category are contained in the following sections. NTIA also permits federal agencies to operate commercial off-the-shelf (COTS) radars, used for non-federal applications. Those radars are exempt from the RSEC but must adhere to the radar FCC type acceptance regulations and must not be modified in any manner by the federal agency using it. A complete description of types of radars that NTIA permits under those regulations and the frequency bands they operate in can be found in Section 5.5.7.6.

## 5.5.2 Applicability of RSEC

Radar Description	Applicable Criteria
<b>Group A</b> Non-pulsed radars of 40 watts or less rated average power; or Pulsed radars of 1 kW or less rated peak power; or Radars with an operating frequency above 40 GHz; or Man-portable <sup>11</sup> radars; or Man-transportable <sup>12</sup> radars; or as described above; or Expendable, non-recoverable radars on missiles	Criteria A See 5.5.7.1
<b>Group B</b> Radars having a rated peak power of more than 1 kW but not more than 100 kW and operating between 2900 MHz and 40 GHz	Criteria B See 5.5.7.2
<b>Group C</b> All radars not included in Group A, B, D, or E	Criteria C See 5.5.7.3
<b>Group D</b> All fixed radars in the 2700-2900 MHz band	Criteria D See 5.5.7.4
<b>Group E</b> Wind Profiler Radar (WPR) operating on 449 MHz	Criteria E See 5.5.7.5

## COTS

Radar Description	Applicable
Commercial off-the-shelf maritime radionavigation radars, airborne weather radars, and altimeters	FCC Criteria See 5.5.7.6

5. For radars employing more than a single emitter, including phased array radars, variable pulse repetition rate (PRR) radars, radars whose modulation changes from pulse to pulse, and other special types of radars for which any of the following criteria cannot be directly applied, special methods may be required in establishing appropriate criteria. Pending adoption of technical criteria for such radars, values submitted for these parameters shall be accompanied by an explanation of their derivation.

6. The provisions of Section 5.5.7.2, Criteria B, are applicable to Class 1 spacebased radar systems on a case-by-case basis.<sup>13</sup> The provisions of Section 5.5.7.2 or Section 5.5.7.3 (i.e. Criteria B or C as appropriate) are applicable to Class 2 spacebased radar systems<sup>14</sup> and active spaceborne sensors<sup>15</sup> on a case-by-case basis.

<sup>11</sup> Man-portable: Items which are designed to be carried as a component part of individual, crew-served or team equipment in conjunction with assigned duties. These items are nominally less than 15 kilograms (32 pounds).

<sup>12</sup> Man-transportable: Items, which are usually transported on, wheeled, tracked or air vehicles but have integral provisions to allow periodic handling by one or more individuals for limited distances (i.e., 100-500 meters). These items are nominally less than 30 kilograms (65 pounds).

<sup>13</sup> Spacebased Radiolocation System--Class 1: a radiolocation system in space the primary function of which is the detection and location of objects on or near the surface of the Earth.

<sup>14</sup> Spacebased Radiolocation System--Class 2: a radiolocation system installed aboard a spacecraft for the purpose of determining the relative positions or velocities of one or more extravehicular objects.

<sup>15</sup> Active Spaceborne Sensor--a measuring instrument in the earth exploration-satellite service, or in the space research service, by means of which physical measurement of various phenomena are obtained through transmission and reception of radio waves.

Measurement procedures for RSEC may be found in Annex M, paragraph M.2.2.1. For those interested in measuring radar emissions, the “*Measurement Procedures for the Radar Spectrum Engineering Criteria (RSEC)*”, is available at <http://www.its.blrdoc.gov/pub/ntia-rpt/05-420/index.php>. 7. The symbols used in the RSEC emission mask and bandwidth equations are defined as follows:

$B(-40\text{ dB})$  = The radar’s permitted bandwidth as determined by the equation for the specific type of modulation, based on the time characteristics of the waveform at the fundamental frequency, which is 40 dB below the peak transmitted power, in MHz.

$B_c$  = The bandwidth of the frequency deviation for a intentionally FM modulated pulsed waveform (The total frequency shift during the pulse duration) in MHz.

$B_{FM/CW}$  = Total frequency deviation for the carrier frequency for the FM/CW radar system.

$B_s$  = Maximum range over which the carrier frequency will be shifted for a frequency hopping radar in MHz.

$CPI$  = Coherent Pulse Interval, a group of transmitted pulses with the same waveform parameters (i.e., pulsewidth, chirp, modulation) that are received and processed by the radar.

$d$  = Pulse compression ratio = emitted pulse duration/compressed pulsed duration (specified at the 50% amplitude points).

$F_o$  = Operating frequency in MHz. For non-FM pulse radars the peak of the power spectrum; for FM pulse radars the average of the lowest and highest carrier frequencies during the pulse.

$F$  = Frequency at which suppression level is calculated for the RSEC mask.

$F_L$  = Lowest operating carrier frequency.

$F_H$  = Highest operating carrier frequency.

$N$  = Total number of chips (subpulses) contained in the pulse. ( $N = 1$  for non-FM and FM pulse radars.)

$PG$  = Processing gain (dB).

$P_p$  = Peak power (dBm).

$PRR$  = Pulse repetition rate in pulses per second.

$P_t$  = Maximum spectral power density (–dBm/kHz).

$S$  = Slope of the RSEC emission mask from the –40 dB point to the –X dB level.

$t$  = Emitted pulse duration in microseconds specified at the 50% amplitude (voltage) points. For coded pulses the pulse duration is the interval between 50% amplitude points of one chip (sub-pulse). The 100% amplitude is the nominal flat top level of the pulse (see Figure 5-3).

$t_r$  = Emitted pulse rise time in microseconds from the 10% to the 90% amplitude points on the leading edge (See Figure 5-3). For coded pulses it is the rise time of a sub-pulse; if the sub-pulse rise time is not discernible, assume that it is 40% of the time to switch from one phase or sub-pulse to the next.

$t_f$  = Emitted pulse fall time in microseconds from the 90 % to the 10 % amplitude points on trailing edge (See Figure 5-3).



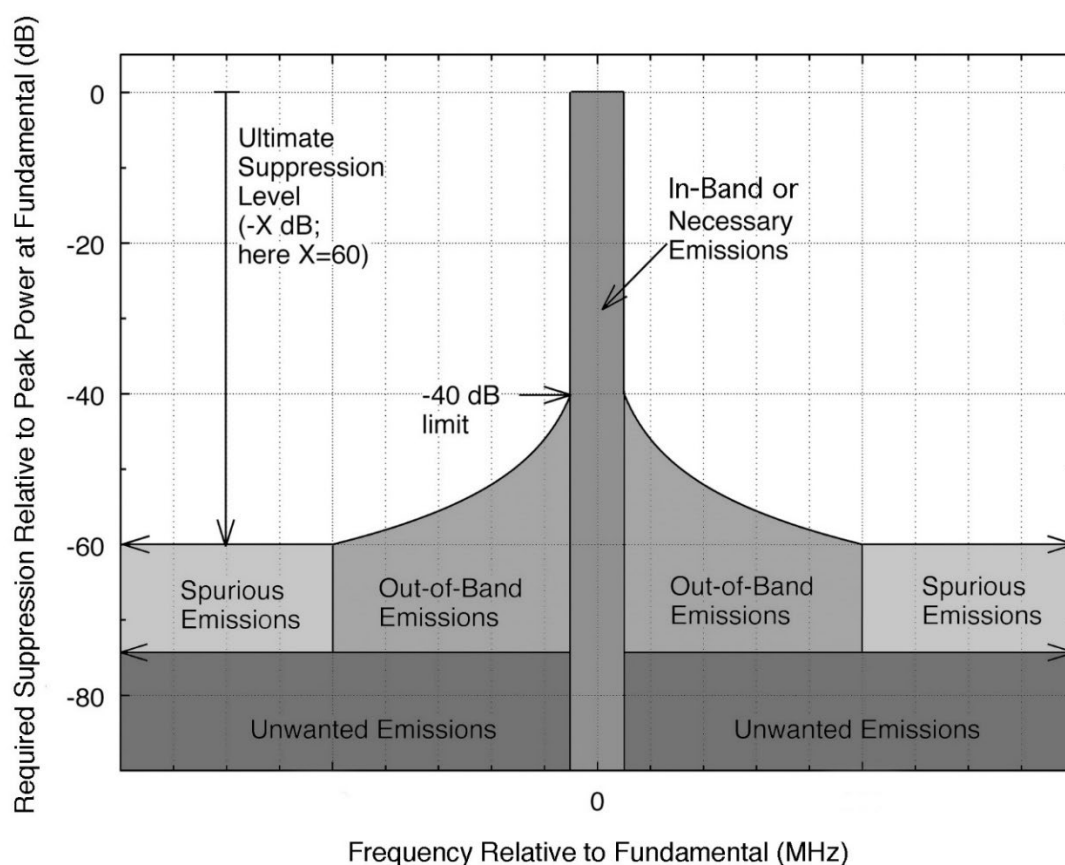
$T_{FM/CW}$  = The FM (chirp) period for the FM/CW radar system.

## Waivers of RSEC

8. Waiver of the requirements herein may be requested when supported by reasonable justification. When technical and engineering data are supplied in support of a request for waiver or in evaluating the performance of equipment, an explanation of the non-conforming parameters and measurement methods employed shall be furnished. Manufacturer's data may be used where deemed appropriate and adequate.

### 5.5.3 RSEC Emission Mask

The RSEC is intended to enhance effective use of spectrum and electromagnetic compatibility (EMC) between radars and other radio systems by placing limits on the amount of energy that a radar system can radiate in various parts of its RF emissions. The RSEC focuses on several emission parameters, including the -40 dB bandwidth, the roll-off in the out-of-band (OOB) region, and the suppression levels in the spurious region. Figure 5-1 shows the various parts of the radar's emissions.

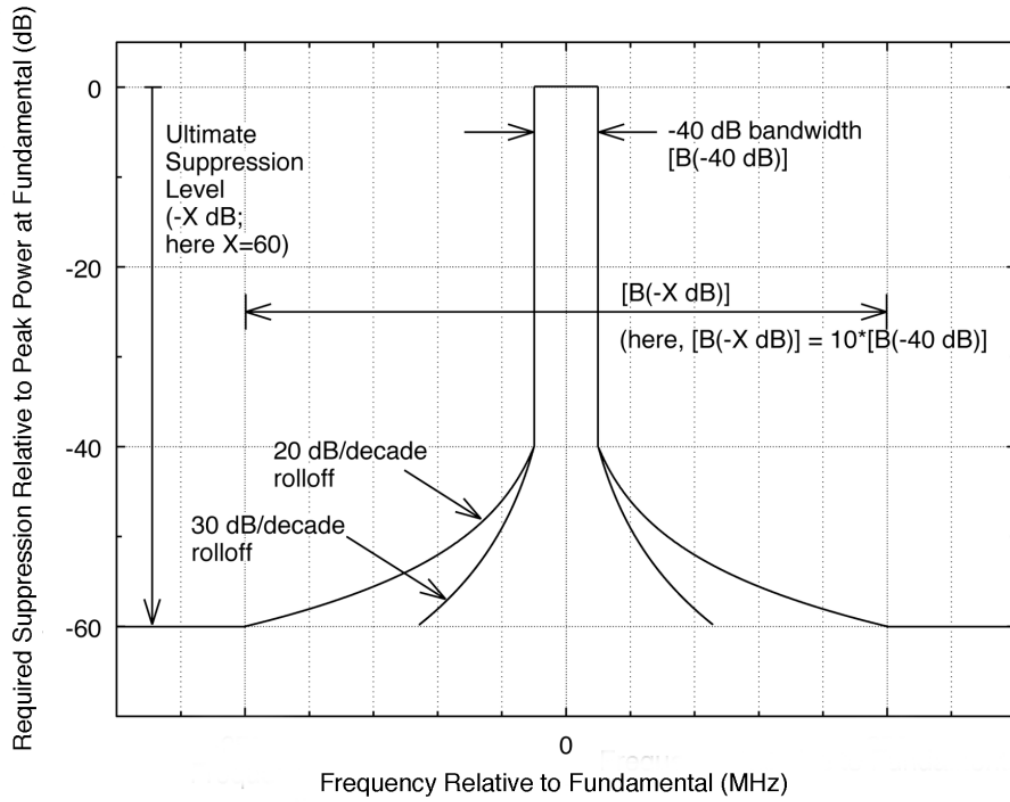


**Figure 5.5.3**

Radar spectrum emission regions of in-band or necessary emissions, out-of-band (OOB) emissions, spurious emissions, and unwanted emissions (which include both the OOB and spurious emissions).

#### 5.5.3.1 Non-Hopping radars

The RSEC mask was developed to place limits on the radar's emissions in all of these regions. An RSEC emission mask is shown in Figure 5-2. Note that in this figure the roll-off is shown both as 20 and 30 dB per decade. Each RSEC criteria has its own set of specifications for the emission mask.



**Figure 5.5.3.1a**

#### **The RSEC Emission mask.**

The RSEC spectrum emission mask consists of three parts: a -40 dB “chimney” around the radar fundamental frequency, an ultimate suppression level of  $-X$  dB (where  $X$  is between 60 to 80 dB, depending upon radar type in the spurious domain), and a sloping roll-off in the out-of-band region that connects the in-band emissions to the spurious emissions. The mask is based on best-case theoretical performance but allows for real-world engineering factors. The -40 dB bandwidth is determined by the radar’s pulse characteristics. The equations are as follows to construct the mask.

$$\text{Eq.1: Suppression (dB)} = -S * \text{Log} \left| \frac{F - F_0}{\frac{1}{2} B(-40\text{dB})} \right| - 40$$

$$\text{Where: } \frac{1}{2} B(-40\text{dB}) \leq |F - F_0| \leq \frac{1}{2} B(-X\text{dB})$$

$F$  is the frequency at which suppression is calculated.

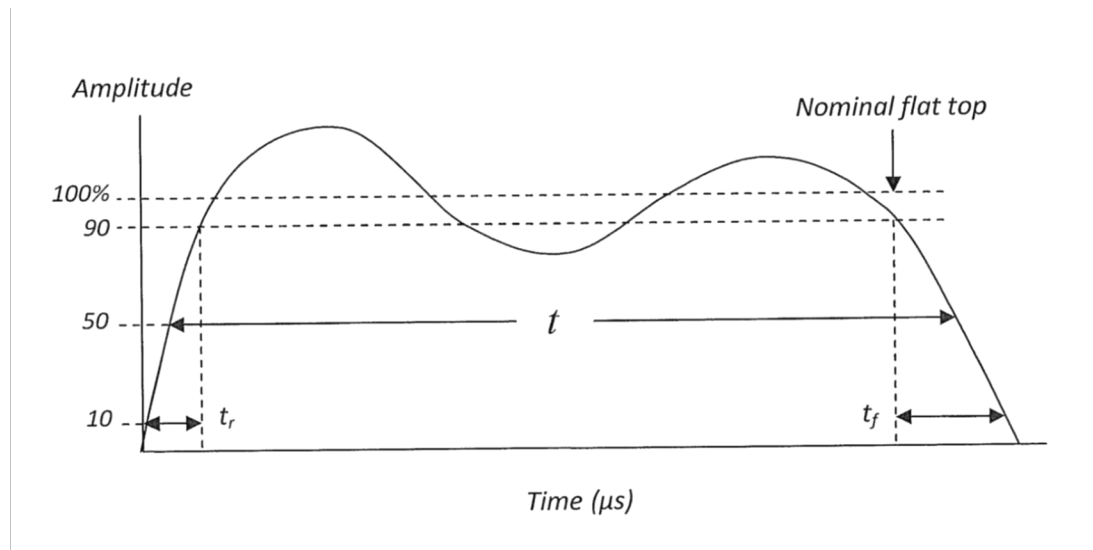
$$\text{and : } B(-X\text{dB}) = (10^\alpha) B(-40\text{dB})$$

$$\text{where } \alpha = \frac{X - 40}{S}$$

Note that the RSEC suppression level in the spurious region is based on emission levels *relative to the peak power* of the transmitter. The  $B(-40 \text{ dB})$  values are calculated based on bandwidth equations in Section 5.5.4 for specific waveform modulations.

The ultimate suppression level at  $-X$  dB in the spurious domain is based on the maximum performance limits of radar transmitter amplifiers. The steepness of the roll-off from the  $-40$  dB bandwidth in the out-of band domain to the  $-X$  dB suppression level depends on a combination of theoretical and real-world performance capabilities.

The time characteristics of the waveform determine the limits of the emission mask based on bandwidth equations for the various types of modulation, including frequency modulated continuous wave, un-modulated pulsed, frequency modulated pulsed, and phase coded pulses. The pulse width ( $t$ ), rise time ( $t_r$ ), and fall time ( $t_f$ ) of a radar pulse for the bandwidth equations are based on the 50% voltage, 10 to 90%, and 90 to 10% time voltages; respectively, as shown in Figure 5-3. The figure is for illustrative purposes only.



**Figure 5.5.3.1b**  
**Schematic radar pulse diagrammed with cursors for rise time, fall time, and width**

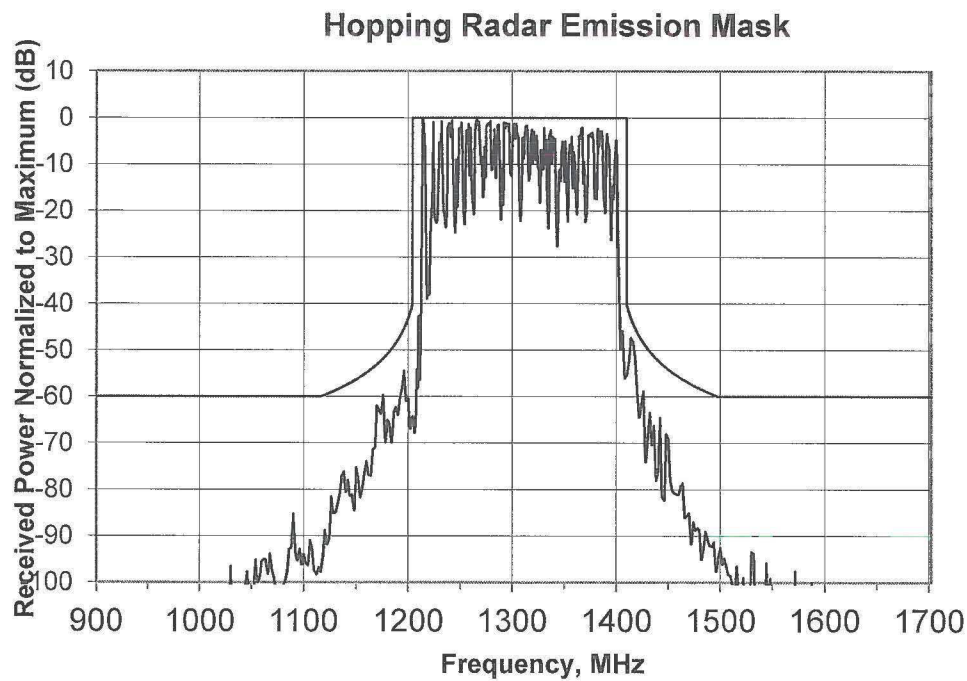
The power levels of the radar's emissions must be less than the values defined by the emission mask for the radar to be compliant with the RSEC. That is, the frequency components of the radar emissions must be contained in the  $-40$  dB bandwidth chimney and the levels in the out-of-band and spurious regions must be below the value defined by the mask.

### 5.5.3.2 Hopping Radars (Contiguous Frequencies)

Many radars in the federal inventory operate by hopping across some number of contiguous channels/frequencies. For these types of radars that cannot normally operate on a single frequency<sup>16</sup>, the RSEC also has a emission masks, based on the lowest operating frequency, the highest operating frequency, and the  $-40$  dB bandwidth of a single instantaneous frequency. Figure 5-4 shows a 16-frequency-hopping radar with its RSEC Criteria C mask. Here, the RSEC mask has been computed for the radar as if it had a single frequency, the mask has been split into two equal halves, each half has been plotted relative to the lowermost and uppermost radar frequencies, and then the center portion of the spectrum, where all of the fourteen remaining frequencies are used, has been connected between the two split halves.

Frequency hopping radars that operate over non-contiguous spectrum will be evaluated on a case-by-case basis.

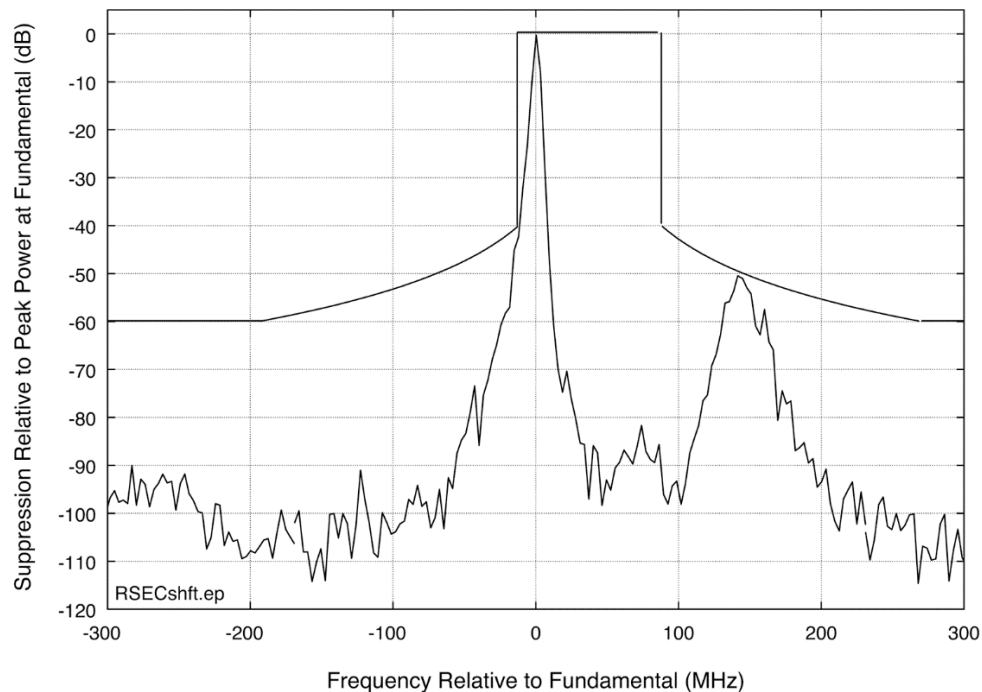
<sup>16</sup> Past measurements have shown that frequency hopping radars that are forced to operate on a single frequency show poorer performance with respect to suppressing spurious emissions.



**Figure 5.5.3.2**  
**Frequency-hopping Radar Emission Spectrum with RSEC-C Mask**

### 5.5.3.3 Shifting the RSEC Mask

The RSEC mask does not need to be centered on the fundamental frequency of the emission spectrum. Figure 5-5 shows a hypothetical case in which an RSEC mask has been shifted upward in frequency to accommodate a feature in a measured emission spectrum. The RSEC mask bandwidths and suppression levels are *not* changed; only the centering of the mask can be shifted. Note that if the RSEC mask were shifted to have the fundamental frequency component centered, the frequency component at about 150 MHz above the fundamental frequency ( $F_0$ ) would exceed the mask's limits.



**Figure 5.5.3.3**  
**RSEC Mask Shifted in Frequency to Accommodate an Emission Spectrum Feature**

### 5.5.4 Non-Hopping Radar -40 dB Bandwidth Equations

The RSEC emission mask is derived from the radar time waveform characteristics, with a key element of the mask being the -40 dB bandwidth. There are many types of radars operating in the various RSEC Categories. However, the waveforms they employ have been arranged into four separate categories. The categories are continuous wave (CW)/frequency modulated continuous wave (FMCW), un-modulated pulsed, FM modulated pulsed, and phase coded pulsed. An -40 dB bandwidth equation was developed for each category that is used in the formation of the RSEC emission mask. The -40 dB bandwidth equations for each type of waveform modulation are as follows.

#### Continuous Wave (CW)/Frequency Modulated Continuous Wave (FMCW) -40 dB Bandwidth Equations

The -40 dB bandwidth equations for radars using CW or FMCW modulated waveforms for Criteria A, B, C, D, and E radars are:

**For CW radars:**  $Eq. 2: B(-40dB) = 0.0003F_0$

**For FM/CW:**  $Eq. 3: B(-40dB) = 1.2 * B_{FM/CW} \left( 1 + \frac{200}{\pi \sqrt{B_{FW/CW} T_{FM/CW}}} \right)^{1/2}$

#### Non-FM pulse radars (including Spread Spectrum and Phase Coded pulse radars) -40 dB Bandwidth Equations

The -40 dB bandwidth equation for **Criteria A and B** radars using non-FM pulsed waveforms is:

$$Eq. 4a: B(-40dB) = \frac{7.6}{\sqrt{t_r t}} \text{ or } \frac{64}{t}$$

whichever is less.

The -40 dB bandwidth equation for **Criteria C** radars using non-FM pulsed waveforms is:

$$Eq. 4b: B(-40dB) = \frac{6.2}{\sqrt{t_r t}} \text{ or } \frac{64}{t}$$

whichever is less.

The -40 dB bandwidth equation for **Criteria D** radars using non-FM pulsed waveforms is:

$$Eq. 4c: B(-40dB) = \frac{6.2}{\sqrt{t_r t}}$$

The -40 dB bandwidth equation for **Criteria E** radars using non-FM pulsed waveforms is:

$$Eq. 4d: B(-40dB) = \frac{6.2}{\sqrt{t_r t}} \text{ or } \frac{64}{t}$$

whichever is less.

If  $t_f$  is less than  $t_r$ , as defined in Section 5.5.1,  $t_f$  is to be used in place of  $t_r$  when performing the emission bandwidth calculations for equations 4a through 4d. Note that Phase-coded waveform refers to the change of the phase during the sub-pulses.

## FM-pulse radars (intentional FM) -40 dB Bandwidth Equations

The -40 dB bandwidth equations for radars using intentional frequency modulated pulsed frequency waveforms (linear and non-linear) are:

For radars procured before October 1, 2020:

$$\text{For Criteria A and B Radars. Eq. 5a: } B(-40dB) = \frac{7.6}{\sqrt{t_r t}} + 2(B_c + \frac{0.065}{t_r})$$

$$\text{For Criteria C Radars. Eq. 5b: } B(-40dB) = \frac{6.2}{\sqrt{t_r t}} + 2(B_c + \frac{0.105}{t_r})$$

$$\text{For Criteria D Radars. Eq. 5c: } B(-40dB) = \frac{6.2}{\sqrt{t_r t}} + 2(B_c + \frac{0.105}{t_r})$$

$$\text{For Criteria E Radars. Eq. 5d: } B(-40dB) = \frac{6.2}{\sqrt{t_r t}} + 2(B_c + \frac{0.105}{t_r})$$

If  $t_f$  is less than  $t_r$ , as defined in Section 5.5.1,  $t_f$  is to be used in place of  $t_r$  when performing the emission bandwidth calculations for Equations 5a through 5d.

For Criteria A, B, C, D, and E radars procured after October 1, 2020:

For Cases when the following two conditions exist:

$$B_c * \min(t_r, t_f) \geq 0.10$$

$$B_c * t \geq 10$$

The following equation will be used:

$$\text{Eq6: } B(-40) =$$

$$1.5 * [B_c + 1.77 * [ \ln(B_c * t)^{0.53} * [ \min(B_{Rise}, B_{Fall}, B_{Rise_{Fall}}) + \max(B_{Rise}, B_{Fall}, B_{Rise_{Fall}}) ] ]]$$

Where:

$$B_{Rise} = \frac{1}{\sqrt{t * t_r}}, B_{Fall} = \frac{1}{\sqrt{t * t_f}}, B_{Rise_{Fall}} = \frac{1}{(t * t_r * t_f)^{1/3}}$$

Otherwise, equations 5a through 5d shall be used for the appropriate RSEC Criteria for FM pulsed systems.

### 5.5.4.1 Frequency Hopping -40 dB Bandwidth Equations

1. For frequency hopping radars the -40 dB bandwidth equations shall be based on the characteristics of the radar operating on a single frequency, according to the modulation and waveform parameters as outlined in Section 5.5.3, where the radar is capable of normally operating in such a mode.

2. For frequency hopping radars where the radar cannot operate on a single frequency for normal operations, the -40 dB bandwidth equations shall be based on the characteristics of the radar operating on a single frequency according to the modulation and waveform parameters as outlined in Section 5.5.3, summed with the hopping

bandwidth,  $B_s$ . These formulas yield the total composite  $B(-40\text{dB})$  bandwidth of a frequency hopping radar as if all channels included within  $B_s$  were operating simultaneously. Individual channels have a  $B(-40\text{ dB})$  radar emission bandwidth given by the equations in Section 5.5.4.

#### Frequency Hopping Non-FM pulse and Phase Coded -40 dB Bandwidth Equations

For Criteria A and B Radars. Eq. 7a :  $B(-40\text{dB}) = \frac{7.6}{\sqrt{t_r t}} + B_s$

For Criteria C Radars. Eq. 7b :  $B(-40\text{dB}) = \frac{6.2}{\sqrt{t_r t}} + B_s$

For Criteria D Radars. Eq. 7c :  $B(-40\text{dB}) = \frac{6.2}{\sqrt{t_r t}} + B_s$

#### Frequency Hopping FM-pulse radars (intentional FM) -40 dB Bandwidth Equations

For radars procured before October 1, 2020:

For Criteria A and B Radars. Eq. 8a :  $B(-40\text{dB}) = \frac{7.6}{\sqrt{t_r t}} + 2(B_c + \frac{0.065}{t_r}) + B_s$

For Criteria C Radars. Eq. 8b :  $B(-40\text{dB}) = \frac{6.2}{\sqrt{t_r t}} + 2(B_c + \frac{0.105}{t_r}) + B_s$

For Criteria D Radars. Eq. 8c :  $B(-40\text{dB}) = \frac{6.2}{\sqrt{t_r t}} + 2(B_c + \frac{0.105}{t_r}) + B_s$

If  $t_f$  is less than  $t_r$ , as defined in Section 5.5.1,  $t_f$  is to be used in place of  $t_r$  when performing the emission bandwidth calculations for Equations 8a through 8c.

For radars procured after October 1, 2020:

For cases when the following two conditions exist:

$$B_c * \min(t_r, t_f) \geq 0.10$$

$$B_c * t \geq 10$$

The following equation will be used:

$$\text{Eq9: } B(-40) =$$

$$1.5 * [B_c + 1.77 * [\ln(B_c * t)^{0.53} * [\text{Min}(B_{\text{Rise}}, B_{\text{Fall}}, B_{\text{Rise\_Fall}}) + \text{Max}(B_{\text{Rise}}, B_{\text{Fall}}, B_{\text{Rise\_Fall}})]]] + B_s$$

Where:

$$B_{\text{Rise}} = \frac{1}{\sqrt{t * t_r}}, B_{\text{Fall}} = \frac{1}{\sqrt{t * t_f}}, B_{\text{Rise\_Fall}} = \frac{1}{(t * t_r * t_f)^{1/3}}$$

Otherwise, Equations 8a through 8c shall be used for the appropriate RSEC Criteria for FM pulsed systems with frequency hopping.

### 5.5.5 The Applicability of the RSEC Effective Dates

Technical criteria for new radars become effective October 1, 2020 except as noted herein. New radars are those for which development and subsequent procurement contracts are let after October 1, 2020. All radars procured prior to October 1, 2020 should be brought into compliance with the following new RSEC standards when any of the following parameters are changed after October 1, 2020: pulse width, pulse rise/fall time, pulse repetition rate, output device, or pulse chirp frequency. The existing radar systems that have been procured, approved by the NTIA SPS up to and including stage four certification prior to October 1, 2020 will be "grandfathered" under the new RSEC rules. These radar systems will not need to be recertified through the SPS unless they are modified as noted.

### 5.5.6 Compliance with RSEC -40 dB Bandwidth and Emission Mask

1. The -40 dB emission bandwidth for radars at either the antenna input or output (radiated) shall not exceed the following limits as defined in Sections 5.5.3.1 for non-hopping radar and 5.5.3.2 for hopping radars for the -40 dB bandwidth equations, based on the type of modulation. Noting that the emission measurements at the antenna input may be used provided they show compliance with the emission mask.

2. Compliance with the emission limits described below for each RSEC Criteria must be shown for all modes and emitted waveforms of the radar system for the emission in-band, roll-off, and spurious limits. For the case where multiple waveforms are emitted on a single frequency, the -40 dB bandwidth for the emission mask should be based on the waveform which results in the largest -40 dB bandwidth. Radars that change waveform parameters during a coherent pulse interval (CPI) will be evaluated on a case-by-case basis.

3. For frequency hopping radars, emission mask as shown in Figure 5-2 shall be determined as if the radar were fixed tuned at the operating frequency of the lowest frequency ( $F_L$ ) and the highest frequency ( $F_H$ ). That is the value of  $F_0$  in equation under Figure 5-2 should be set to the values of  $F_L$  and  $F_H$  for determining the roll-off from the -40 dB bandwidth point. The mid value of the frequency hopping range shall not be used for the value of  $F_0$ . An example of an emission mask applied to a frequency hopping radar is shown in Figure 5-4.

4. Normally the emission mask is centered at  $F_0$ , however the mask can be moved to the right or left of  $F_0$  if the power of a frequency component(s) exceed the mask's limits. Shifting the mask frequency permits radars to show that their emissions are compliant. Figure 5-5 illustrates this case. Note that in this figure, the mask itself is not changed with respect to the -40 dB bandwidth, roll-off, and spurious emission limits. Figure 5-5 shows that the mask has been shifted to the right to permit the frequency component at about 150 MHz above the fundamental to be under the power limits specified by the mask at that frequency while the component at  $F_0$  is also still compliant. Shifting the mask to make one area of the radar's emissions compliant, while causing another area to become non-compliant, is not permitted.

5. A computer model is available to calculate the emission mask, import measured data, and allow the user to enter discrete emission points to determine whether a radar is compliant with the RSEC emission limits. The model can be obtained by contacting NTIA's Spectrum Engineering Branch.

### 5.5.7 RSEC Criteria

The RSEC has five different criteria identified as A, B, C, D, and E. The following sections give details with respect to standards for roll-off, tunability, receiver standards, antenna patterns, and interference suppression for each criterion. The -40 dB bandwidth equations are contained in Section 5.5.4 for single frequency radars and 5.5.4.1 for frequency hopping radars.

#### 5.5.7.1 RSEC Criteria A

RSEC A radar systems that have been submitted to or certified by NTIA before December 31, 2013, are exempt from meeting new RSEC A requirements and shall be "grandfathered". Grandfathered systems shall be certified under the NTIA rules applicable prior to December 31, 2013. Systems certified by NTIA at Stage 3 to Section 5.2.2.2 of the NTIA Manual before the date shall be certified at Stage 4 using the same criteria until December 31, 2015. On January 1, 2016 all systems seeking Criteria A certification must meet these requirements.



## Criteria A Applicability

**Radars shall be grouped into Criteria A that have the following system characteristics:** Non-pulsed radars of 40 watts or less rated average power; or pulsed radars of 1 kW or less rated peak power; or radars with an operating frequency above 40 GHz; or Man-portable<sup>11</sup> radars; or man-transportable<sup>12</sup> radars; or as described above; or expendable, non-recoverable radars on missiles.

Previously certified Criteria A systems must adhere to the revised regulations when any of the following system parameters are changed, including power output, pulse width, pulse repetition rate, chirp rate, chirp bandwidth, rise time, and fall time.

## Criteria A Emission Mask

### For systems operating in the band 2700 – 2900 MHz

Systems operating in this band must adhere to the RSEC Criteria D standard in section 5.5.2.4.

### For systems operating in other frequency bands

For these types of radars, the emission levels at the antenna input or output (radiated) shall be no greater than the values obtainable from the curve in Figure 5-2.

## -40 dB bandwidth Equations

The -40 dB bandwidth equations are contained in Section 5.5.4 for single frequency radars and 5.5.4.1 for frequency hopping radars.

## Roll-off in the Out-of-Band (OOB) Domain

At the frequency  $B(-40\text{dB})/2$  displaced from  $F_0$ , the level shall be at least 40 dB below the maximum value. Between the  $-40\text{dB}$  and  $-X\text{dB}$  frequencies the level shall meet a slope (S) of 20 dB per decade ( $S=20$ ) for all waveforms when the peak power is greater than 1 watt.

## Spurious Domain Limits

At and beyond the frequencies  $B(-X\text{dB})/2$  from  $F_0$ , the  $X(\text{dB})$  level shall be at least the dB value below the maximum spectral power density given by:

For radar systems with peak power above 100 watts:  $X(\text{dB}) = 55 \text{ dB}$ .

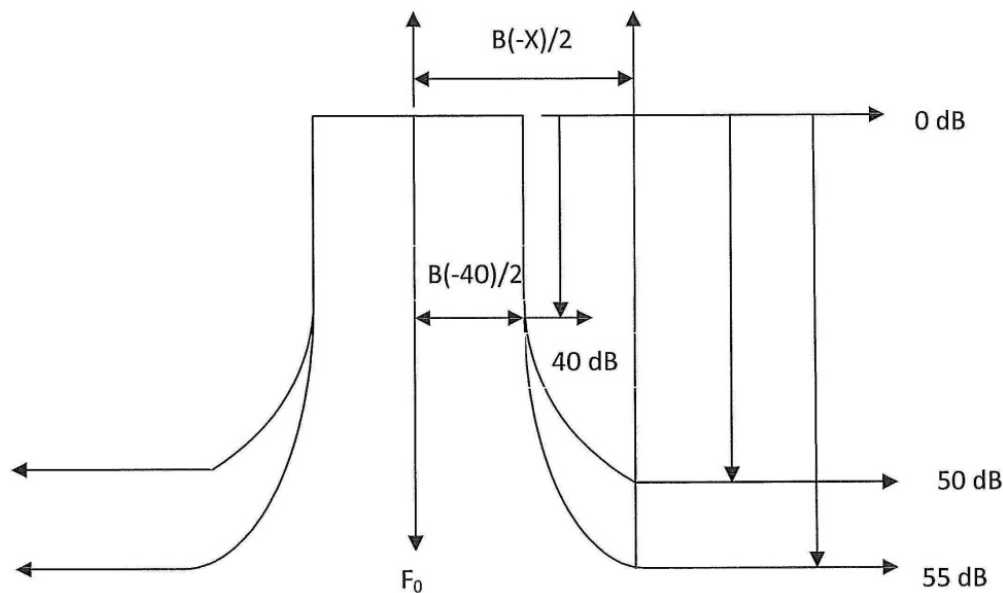
For radar systems with peak power less than 100 watts but more than 1 watt:  $X(\text{dB}) = 50 \text{ dB}$ .

For radar systems with peak power equal to and less than 1 watt:  $X(\text{dB}) = 40 \text{ dB}$ .

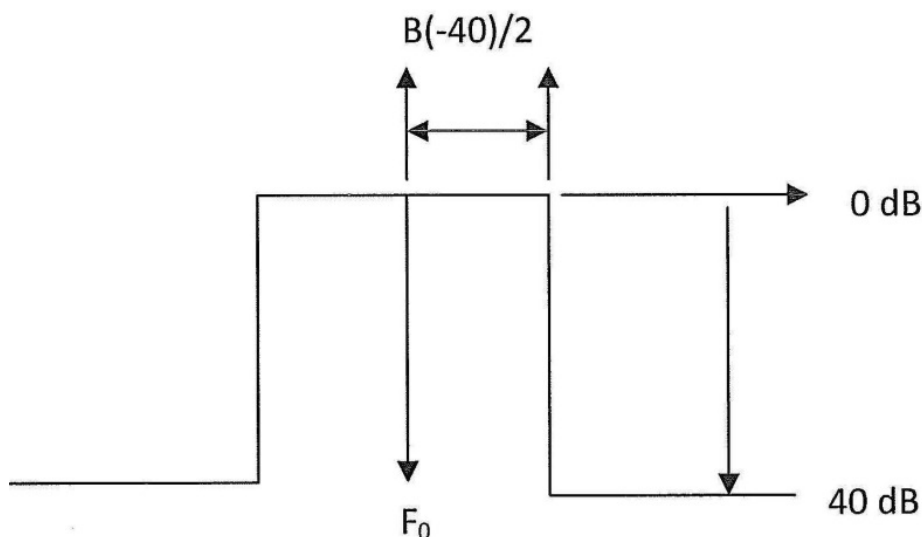
For radar systems with a duty cycle equal to and greater than 10 percent:  $X(\text{dB}) = 55 \text{ dB}$ .

All harmonic levels shall be at a level that is at least 55 dB below the maximum power spectral density.

The two figures illustrate the suppression levels and masks for Criteria A systems.



**Figure 5-6**  
**RSEC A Masks for Systems with Peak Power Above 1 Watt**



**Figure 5-7**  
**RSEC A Mask for Systems with Peak Power Equal to and Below 1 Watt**

#### **Criteria A Antenna Pattern**

For systems operating in the bands 1215-1390, 5600-5650, and 9000-9200 MHz the first antenna sidelobe shall be suppressed 10 dB when the peak power is greater than 1 watt. An exceptions to the policy will be made for radar systems employing an omni directional antenna.

#### **Criteria A Radar Tunability**

Each radar shall be tunable in an essentially continuous manner either over the allocated bands for which it is designed to operate, or over a band which is 10% of the midband frequency. Crystal controlled radars conform to this requirement if operation at essentially any frequency across the band can be achieved with a crystal change. A digital tuner having stepwise tuning increments no greater than 1% of the overall tuning range of the device, across the entire tuning range, shall be considered as meeting the RSEC-A tunability criterion. Fixed tuning is permitted if there is some means or method to change the operating frequency to mitigate interference or justification is provided.

## Criteria A Radar Receivers

The overall receiver selectivity characteristics shall be commensurate with the transmitter bandwidth, as portrayed in Figure 5-2. This standard applies until January 1, 2022.

The 3 dB IF bandwidth of the radar receiver shall be equal to or less than 13 times the 3 dB bandwidth of the emissions, for all modulation types. For multi-stage IF radar receivers, the standard would apply to the final IF stage, prior to the detector or I and Q digitizer. This standard only applies to radars with superhetrodyne receivers. Stage 4 systems will be grandfathered, but they will have to meet the standard if the receiver is altered or redesigned. This standard will come into effect on January 1, 2022.

Rejection of spurious responses, other than image responses, shall be 50 dB or better. Receivers shall not exhibit any local oscillator radiation greater than -40 dBm at the receiver input terminals. The frequency stability shall be commensurate with, or better than, that of the associated transmitter.

## Criteria A Measurement Capability

See paragraph M.2.2 of Annex M.

### 5.5.7.2 RSEC Criteria B

#### Criteria B Applicability

Radars shall be grouped into Criteria B that have the following system characteristics: A rated peak power of more than 1 kW but not more than 100 kW and operating between 2900 MHz and 40 GHz.

#### Criteria B Emission Mask for Un-modulated Pulsed, FM Pulsed, and Phase Coded Radars

For these types of radars, the emission levels at the antenna input or output (radiated) shall be no greater than the values obtainable from the curve in Figure 5-2. The -40 dB bandwidth equations are contained in Section 5.5.4 for single frequency radars and 5.5.4.1 for frequency hopping radars. At the frequency  $B(-40\text{dB})/2$  displaced from  $F_0$ , the level shall be at least 40 dB below the maximum value. Between the -40 dB and -X dB frequencies the level shall be below the 20 dB per decade ( $S=20$ ) roll-off lines in Figure 5-2 for those radars procured before October 1, 2020. For radars procured after October 1, 2020 the slope shall be 30 dB per decade ( $S=30$ ) for all Un-modulated pulsed, FM pulsed and FM pulsed frequency hopping radars. The roll-off of phase coded radars will remain at a slope of 20 dB per decade ( $S=20$ ). In addition, the roll-off of any other waveforms that are not specified in this section will remain at a slope of 20 dB per decade ( $S=20$ ). At and beyond the frequencies  $B(-X\text{dB})/2$  from  $F_0$ , the level shall be at least the dB value below the maximum spectral power density given by:

$$X(\text{dB}) = 60\text{dB} \text{ or } X(\text{dB}) = P_t + 30$$

whichever is the larger value

NOTE:  $P_t$  may be measured or may for the purpose of these criteria be calculated from the following:<sup>17</sup>

$$Eq.10: P_t = P_p + 20\log(N * t) + 10\log(PRR) - PG - 90$$

where  $PG = 0$ , for non-FM, non-encoded pulse radars

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<sup>17</sup> Although this equation seems incorrect to have 10 and 20 log terms in it, the equation is correct. In essence it make the  $X(\text{dB})$  term lower (more suppression) when the radar's duty cycle increases.

$PG = 10\log(d)$ , for FM pulse radars, where  $d$  = pulse compression ratio = emitted pulse duration/compressed pulsed duration (at 50% amplitude points).

$PG = 10\log(N)$ , for coded pulse radars, where  $N$  = total number of chips (subpulses) contained in the pulse. ( $N = 1$  for non-FM and FM pulse radars.)

### **Criteria B Emission Mask for Continuous Wave (CW) and FM/CW Radars**

For these types of radars, the levels of all emissions at the antenna input or output (radiated) shall be no greater than the values obtainable from the curve in Figure 5-2. The -40 dB bandwidth equations are contained in Section 5.5.4. At the frequencies  $B(-40 \text{ dB})/2$  displaced from  $F_0$ , the level shall be at least 40 dB below the maximum value. Between the -40 dB and -X dB frequencies, the level shall be below the 20 dB per decade ( $S=20$ ) roll-off lines in Figure 5-2. At and beyond the frequencies  $B(X \text{ dB})/2$  from  $F_0$ , the level shall be at least 60 dB below the maximum level of the signal contained within  $B(-40 \text{ dB})$ . All levels are specified for a 1.0 kHz measurement bandwidth.

### **Criteria B Antenna Pattern**

No requirement is specified.

### **Criteria B Radar Tunability**

Each radar shall be tunable in an essentially continuous manner either over the allocated bands for which it is designed to operate, or over a band which is 10% of the midband frequency. Crystal controlled radars conform to this requirement if operation at essentially any frequency across the band can be achieved with a crystal change.

### **Criteria B Radar Receivers**

The overall receiver selectivity characteristics shall be commensurate with or narrower than the transmitter bandwidth, as portrayed in Figure 5-2. This standard applies until January 1, 2022.

The 3 dB IF bandwidth of the radar receiver shall be equal to or less than 20 times the 3 dB bandwidth of the emissions, for all modulation types. For multi-stage IF radar receivers, the standard would apply to the final IF stage, prior to the detector or I and Q digitizer. This standard only applies to radars with superhetrodyne receivers. Stage 4 systems will be grandfathered, but they will have to meet the standard if the receiver is altered or redesigned. This standard will come into effect on January 1, 2022.

Rejection of spurious responses, other than image responses, shall be 50 dB or better except where broadband front ends are required operationally.

Receivers shall not exhibit any local oscillator radiation greater than -40 dBm at the receiver input terminals. The frequency stability shall be commensurate with, or better than, that of the associated transmitter.

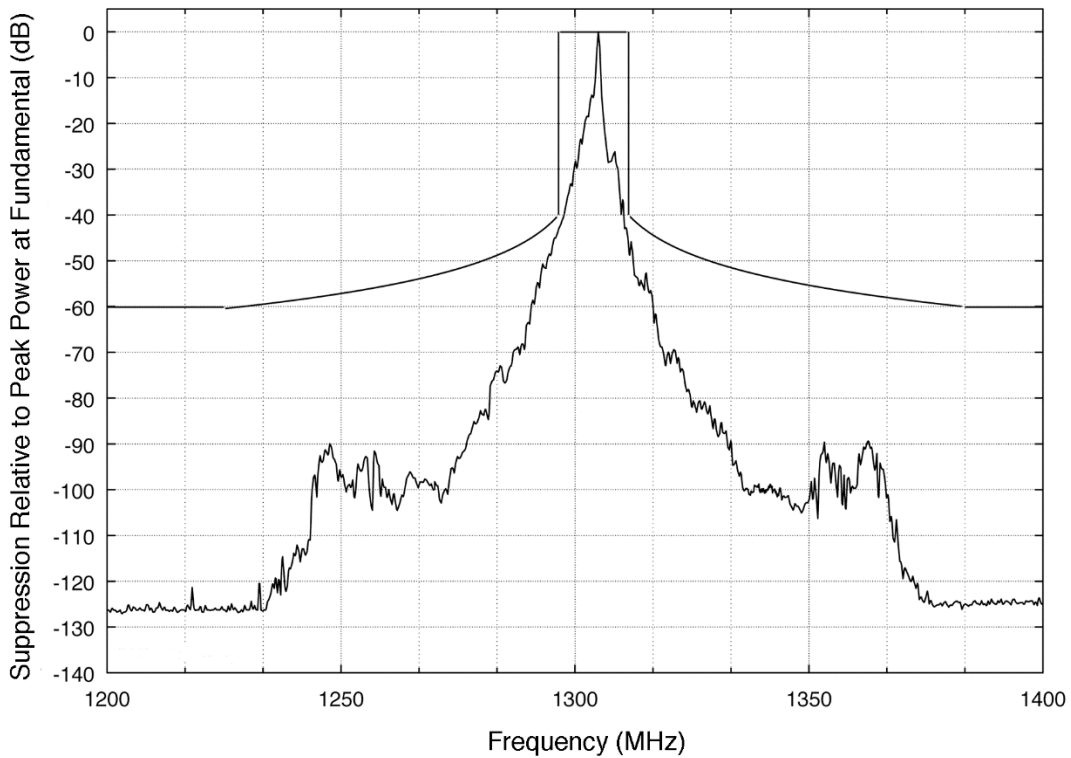
### **Criteria B Measurement Capability**

See paragraph M.2.2.2 of Annex M.

## **5.5.7.3 RSEC Criteria C**

### **Criteria C Applicability**

Radars shall be grouped into Criteria C that have the following system characteristics: All radars below 40 GHz not included in Group A, B, D, or E. Figure 5-8 shows a RSEC C mask applied to a radar system.



**Figure 5-8**  
**Example of Criteria C Mask Applied to a Radar**

### Criteria C Emission Mask for Un-modulated Pulsed, FM Pulsed, and Phase Coded Radars

For these types of radars, the emission levels at the antenna input or output (radiated) shall be no greater than the values obtainable from the curve in Figure 5-2. The -40 dB bandwidth equations are contained in Section 5.5.4 for single frequency radars and 5.5.4.1 for frequency hopping radars. At the frequency  $B(-40\text{dB})/2$  displaced from  $F_0$ , the level shall be at least 40 dB below the maximum value. Between the -40 dB and -X dB frequencies the level shall be below the 20 dB per decade ( $S=20$ ) roll-off lines in Figure 5-2 for those radars procured before October 1, 2020. For radars procured after October 1, 2020 the slope shall be 30 dB per decade ( $S=30$ ) for all Un-modulated pulsed, FM pulsed and FM pulsed frequency hopping radars. The roll-off of phase coded radars will remain at a slope of 20 dB per decade ( $S=20$ ). In addition, the roll-off of any other waveforms that are not specified in this section will remain at a slope of 20 dB per decade ( $S=20$ ). At and beyond the frequencies  $B(-X\text{dB})/2$  from  $F_0$ , the level shall be at least the dB value below the maximum spectral power density given by:

$$X(\text{dB}) = 60\text{dB} \text{ or } X(\text{dB}) = P_t + 30$$

whichever is the larger value

NOTE:  $P_t$  may be measured or may for the purpose of these criteria be calculated from the following:<sup>18</sup>

$$Eq.11: P_t = P_p + 20\log(N * t) + 10\log(PRR) - PG - 90$$

<sup>18</sup> Although this equation seems incorrect to have 10 and 20 log terms in it, the equation is correct. In essence it make the X(dB) term lower (more suppression) when the radar's duty cycle increases.

where  $PG = 0$ , for non-FM, non-encoded pulse radars

$PG = 10\log(d)$ , for FM pulse radars, where  $d$  = pulse compression ratio = emitted pulse duration/compressed pulsed duration (at 50% amplitude points).

$PG = 10\log(N)$ , for coded pulse radars, where  $N$  = total number of chips (subpulses) contained in the pulse. ( $N = 1$  for non-FM and FM pulse radars.)

### **Criteria C Emission Mask for Continuous Wave (CW) and FM/CW radars**

The levels of all emissions for these types of radars at the antenna input or output (radiated) shall be no greater than the values obtainable from the curve in Figure 5-2. The -40 dB bandwidth equations are contained in Section 5.5.4. At the frequencies  $B(-40 \text{ dB})/2$  displaced from  $F_0$ , the level shall be at least 40 dB below the maximum value. Between the -40 dB and -X dB frequencies, the level shall be below the 20 dB per decade ( $S=20$ ) rolloff lines in Figure 5-2. At and beyond the frequencies  $B(X \text{ dB})/2$  from  $F_0$ , the level shall be at least 60 dB below the maximum level of the signal contained within  $B(-40 \text{ dB})$ .

### **Compatibility with EESS (Passive Systems)**

In the design and operation of systems in the radiolocation service that operate in the band 1350-1390 MHz, agencies are encouraged to take all feasible steps so that unwanted emission powers may not exceed -29 dBW in the Earth exploration-satellite service (passive) band 1400-1427 MHz.

### **Criteria C Antenna Pattern**

Since electromagnetic compatibility considerations involved phenomena which may occur at any angle, the allowable antenna patterns for many radars may be usefully described by “median gain” relative to an isotropic antenna<sup>19</sup>. Antennas operated by their rotation through 360 degrees of the horizontal plane shall have a “median gain” of -10 dBi or less, as measured on an antenna test range, in the principal horizontal plane. For other antennas, suppression of lobes other than the main antenna beam shall be provided to the following levels, relative to the main beam:

first three sidelobes: 17 dB;  
all other lobes: 26 dB.

### **Criteria C Radar Tunability**

Each radar shall be tunable in an essentially continuous manner either over the allocated bands for which it is designed to operate, or over a band which is 10% of the mid-band frequency. Crystal controlled radars conform to this requirement if operation at essentially any frequency across the band can be achieved with a crystal change.

### **Criteria C Radar Receivers**

The overall receiver selectivity characteristics shall be commensurate with or narrower than the transmitter bandwidth, as portrayed in Figure 5-2. This standard applies until January 1, 2022.

The 3 dB IF bandwidth of the radar receiver shall be equal to or less than 20 times the 3 dB bandwidth of the emissions, for all modulation types. For multi-stage IF radar receivers, the standard would apply to the final IF stage, prior to the detector or I and Q digitizer. This standard only applies to radars with superhetrodyne receivers. Stage 4 systems will be grandfathered, but they will have to meet the standard if the receiver is altered or

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<sup>19</sup> Median gain is defined as that level over an angular region at which the probability is 50% that the observed or measured gain at any position of the antenna will be less than or equal to that level.

redesigned. This standard will come into effect on January 1, 2022.

Receivers shall be capable of switching bandwidth limits to appropriate values whenever the transmitter bandwidth is switched (pulse shape changed). Receiver image rejection shall be at least 50 dB; rejection of other spurious responses shall be at least 60 dB. Radar receivers shall not exhibit any local oscillator radiation greater than -40 dBm at the receiver input terminals. Frequency stability of receivers shall be commensurate with, or better than, that of the associated transmitters.

## Criteria C Measurement Capability

See paragraph M.2.2.3 of Annex M

### 5.5.7.4 RSEC Criteria D

#### Criteria D Applicability

Radars shall be grouped into Criteria D that have the following system characteristics: Fixed radars operating in the 2700-2900 MHz band. All radars subject to these criteria shall be designed and constructed to meet the basic minimum electromagnetic compatibility (EMC) requirements stated herein. In addition to the basic minimum EMC requirements, radar systems in the 2700-2900 MHz band which are intended to operate in close proximity to other equipment in the band or operate in areas specified in Annex D shall be designed and constructed to permit, without modification to the basic equipment, field incorporation of EMC enhancement provisions. These additional provisions will improve the electromagnetic compatibility of the radar thus improving the accommodation of the radar system in the band. These provisions are stated in Section 5.5.7.4, in subsection titled Criteria D EMC Provisions. A Criteria D mask applied to a pulsed radar is shown in Figure 5-9. The measured emissions are within the -40 dB bandwidth limit, and the frequency components in the out-of-band and spurious regions do not exceed the emission mask limits, which were based on the time waveform characteristics of the radar signal.

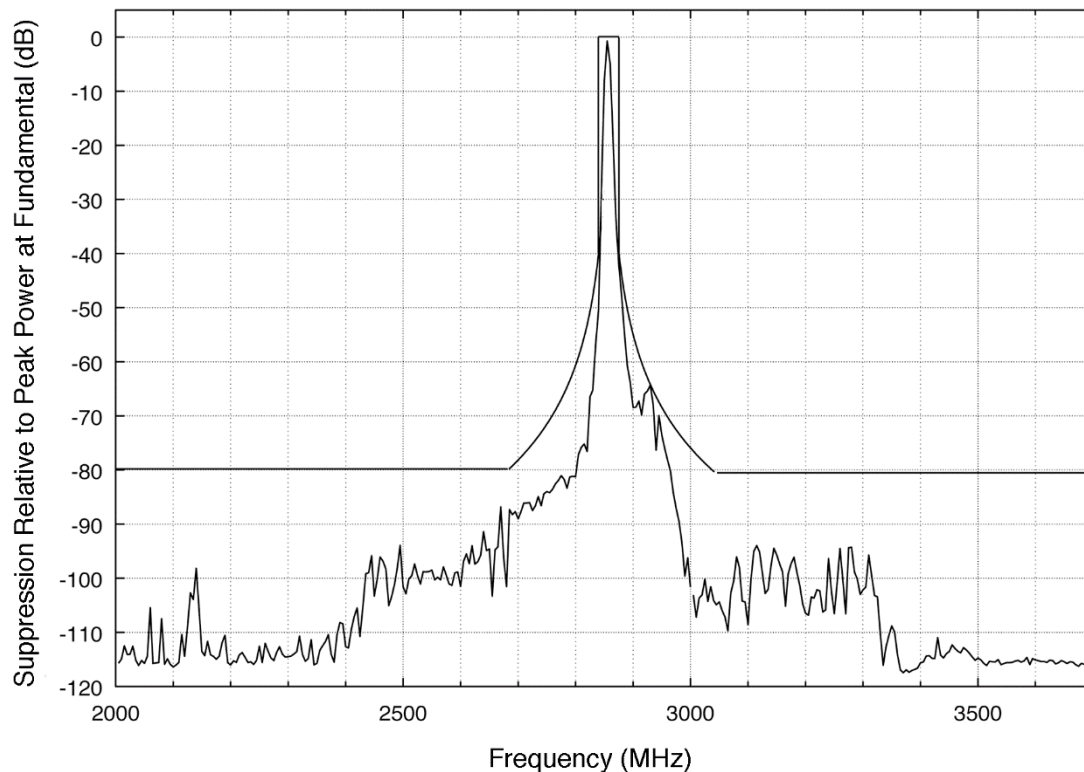


Figure 5-9

## Criteria D Mask Applied to Radar Emissions

### Criteria D Emission Mask for Non-FM Pulsed, FM Pulsed, and Phase Coded radars

The emission levels at the antenna input or output (radiated) for these types of radars shall be no greater than the values obtainable from the curve in Figure 5-2. The -40 dB bandwidth equations are contained in Section 5.5.4 for single frequency radars and 5.5.4.1 for frequency hopping radars. At the frequencies  $\pm B(-40 \text{ dB})/2$  displaced from  $F_0$  the level shall be at least 40 dB below the maximum value. Beyond the frequencies  $\pm B(-40 \text{ dB})/2$  from  $F_0$ , the emission level(s), with the exception of harmonic frequencies, shall be below the 40 dB per decade ( $S=40$ ) roll-off lines of Figure 5-2 down to a  $-X$  dB level that is 80 dB below the maximum spectral power density. All harmonic frequencies shall be at a level that is at least 60 dB below the maximum spectral power density.

### Criteria D Emission Mask for Continuous Wave (CW) and FM/CW radars

The levels of all emissions at the antenna input or output (radiated) for these types of radars shall be no greater than the values obtainable from the curve in Figure 5-2. The -40 dB bandwidth equations are contained in Section 5.5.4. At the frequencies  $\pm B(-40 \text{ dB})/2$  displaced from  $F_0$ , the level shall be at least 40 dB below the maximum value. Between the -40 dB and  $-X$  dB frequencies, the level shall be below the 40 dB per decade ( $S=40$ ) roll-off lines in Figure 5-2. At and beyond the frequencies  $B(-X \text{ dB})/2$  from  $F_0$ , the level shall be at least 80 dB below the maximum level of the signal contained with  $B(-40 \text{ dB})$ . All levels are specified for a 1.0 kHz measurement bandwidth.

### Criteria D Antenna Pattern

Since electromagnetic compatibility considerations involved phenomena which may occur at any angle, the allowable antenna patterns for many radars may be usefully described by “median gain” relative to an isotropic antenna<sup>20</sup>. Antennas operated by their rotation through 360 degrees of the horizontal plane shall have a “median gain” of -10 dBi or less, as measured on an antenna test range, in the principal horizontal plane. For other antennas, suppression of lobes other than the main antenna beam shall be provided to the following levels, relative to the main beam:

First three sidelobes 17 dB;  
All other lobes 26 dB.

### Criteria D Radar Tunability

Radar systems shall be tunable over the entire 2700-2900 MHz band.

### Criteria D Radar Receivers

The overall receiver selectivity characteristics shall be commensurate with the transmitter bandwidth, as portrayed in Figure 5-2. This standard applies until January 1, 2022.

The 3 dB IF bandwidth of the radar receiver shall be equal to or less than 1.75 times the 3 dB bandwidth of the emissions, for all modulation types. For multi-stage IF radar receivers, the standard would apply to the final IF stage, prior to the detector or I and Q digitizer. This standard only applies to radars with superheterodyne receivers. Stage 4 systems will be grandfathered, but they will have to meet the standard if the receiver is altered or redesigned. This standard will come into effect on January 1, 2022.

Receivers shall be capable of switching bandwidth limits to appropriate values whenever the transmitter bandwidth is switched (pulse shape changed). Receiver image rejection shall be at least 50 dB; rejection of other

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<sup>20</sup> Median gain is defined as that level over an angular region at which the probability is 50% that the observed or measured gain at any position of the antenna will be less than or equal to that level.



spurious responses shall be at least 60 dB. Radar receivers shall not exhibit any local oscillator radiation greater than -40 dBm at the antenna input terminals. Frequency stability of receivers shall be commensurate with, or better than, that of the associated transmitters.

### **Criteria D EMC Provisions**

To improve the accommodation of radar systems in the 2700-2900 MHz band, which operate in close proximity to other equipment in the band or operate in geographical areas specified in Annex D, the radar shall be designed and constructed to permit, without modification to the basic equipment, field incorporation of system EMC provisions. These provisions include the requirement to meet specifications in accordance with paragraphs a. and b. below and the recommendation to meet guidelines in accordance with paragraph c below.

#### **a. Emission Levels**

The radar emission levels at the antenna input or output (radiated) shall be no greater than the values obtainable from the curves in Figure 5-2. At the frequency  $\pm B(-40 \text{ dB})/2$  displaced from  $F_o$ , the level shall be at least 40 dB below the maximum value. Beyond the frequencies  $\pm B(-40 \text{ dB})/2$  from  $F_o$ , the equipment shall have the capability to achieve up to 80 dB per decade ( $S=80$ ) roll-off lines of Figure 5-2. The emission levels, with the exception of harmonic frequencies, shall be below the appropriate dB per decade roll-off lines of Figure 5-2 down to a -X dB level that is 80 dB below the maximum spectral power density. All harmonic frequencies shall be at a level that is at least 60 dB below the maximum spectral power density.

#### **b. Radar System PRR**

The radar system shall be designed to operate with an adjustable pulse repetition rate (s), PRR (s), with a nominal difference of 1% (minimum). This will permit the selection of PRRs to allow certain types of receiver interference suppression circuitry to be effective.

#### **c. Receiver Interference Suppression Circuitry**

Radar systems in this band should have provisions incorporated into the system to suppress pulsed interference. The following information is intended for use as an aid in the design and development of receiver signal processing circuitry or software to suppress asynchronous pulsed interference. A description of the parametric range of the expected environmental signal characteristics at the receiver Intermediate Frequency (IF) output is:

Peak Interference-to-Noise Ratio: < 50 dB

Pulse width: 0.5 to 4.0 microseconds

PRR: 100 to 2000 pulses per second

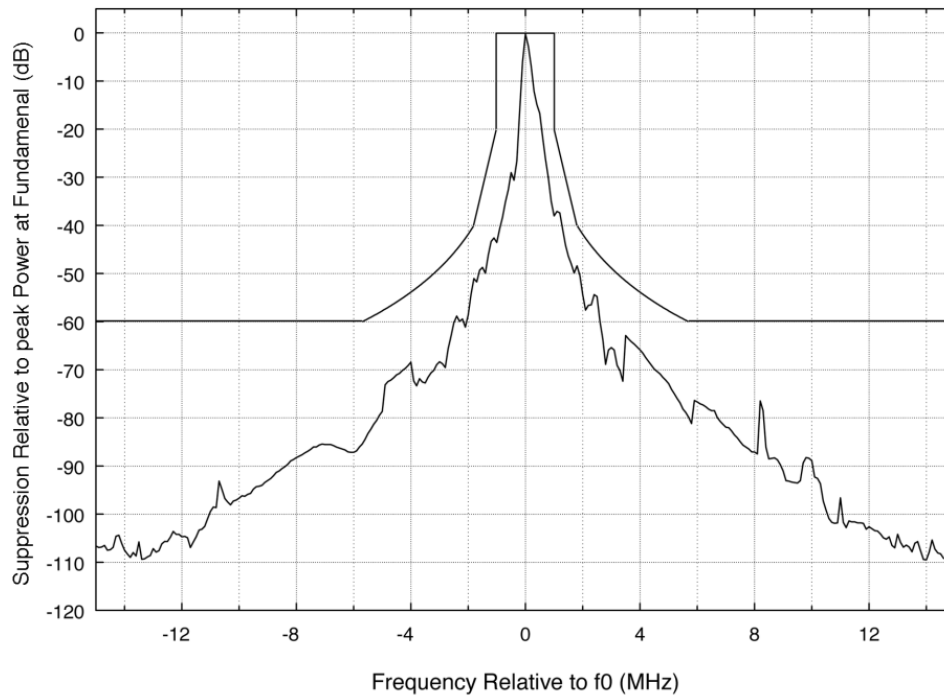
### **Criteria D Measurement Capability**

See paragraph M.2.2.3 of Annex M.

## **5.5.7.5 RSEC Criteria E**

### **Criteria E Applicability**

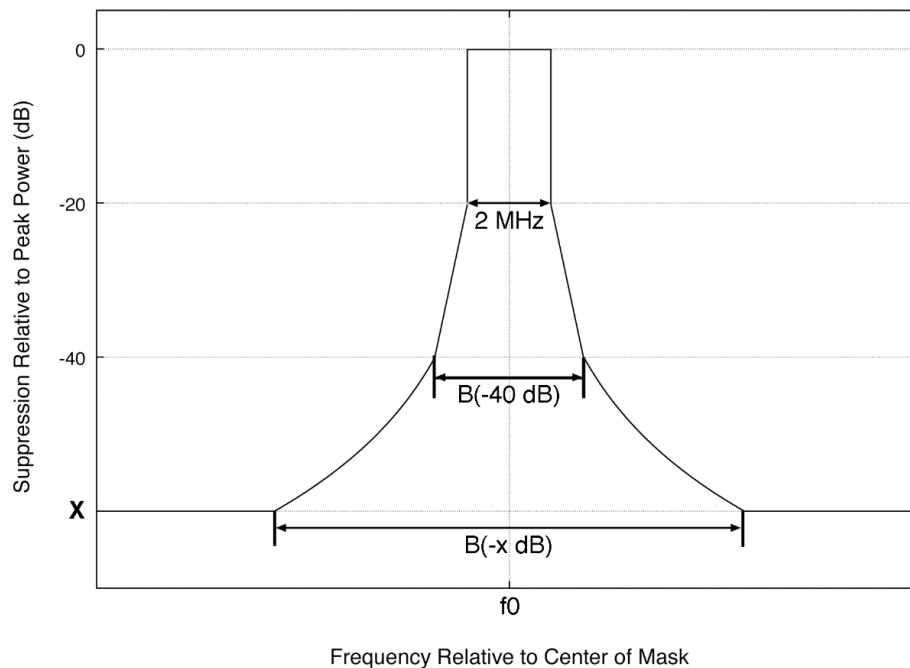
Radars shall be grouped into Criteria E that have the following system characteristics: Wind Profile Radar (WPR) operating on 449 MHz. Note that the mask for Criteria E radars is different from the other criteria masks in that it has two sections of different slope in the out-of-band region. Figure 5-10 is an example of a Criteria E mask applied to a WPR. The measured emissions are within the -40 dB bandwidth limit, and the frequency components in the out-of-band and spurious regions do not exceed the emission limits of the mask, which were based on the time waveform characteristics of the radar signal.



**Figure 5-10**  
**Example of Criteria E Mask applied to Wind Profile Radars**

#### Criteria E Emission Mask for all Modulations

WPR emission levels at the antenna input or output (radiated) shall be no greater than the values obtainable from the curve in Figure 5-9. The -40 dB bandwidth equations are contained in Section 5.5.4. At the frequencies  $\pm B(-40 \text{ dB})/2$  displaced from  $F_0$ , the level shall be at least 40 dB below the maximum value. Between the -40 dB and -X dB frequencies, the level shall be below the 40 dB per decade ( $S=40$ ) roll-off lines in Figure 5-11.



**Figure 5-11**  
**Radar Emission Bandwidth and Emission Levels for Wind Profiler Radars at 449 MHz (Criteria E)**

Note: The roll-off slope,  $S$ , from the -40 dB to -X dB points is at 40 dB per decade for Criteria E. The -20 dB bandwidth is limited to 2 MHz for Wind Profiler radars operating at 449 MHz. The maximum emission spectrum

level between the -40 and -X dB points for S dB per decade slope is described by the formula:

$$\text{Eq.12 Suppression (dB)} = -S * \text{Log} \left| \frac{F - F_0}{\frac{1}{2} B(-40\text{dB})} \right| - 40$$

$$\text{Where: } \frac{1}{2} B(-40\text{dB}) \leq |F - F_0| \leq \frac{1}{2} B(-X\text{dB})$$

And: F is the frequency at which suppression is calculated.

$$\text{and: } B(-X\text{dB}) = (10^\alpha) B(-40\text{dB})$$

$$\text{where } \alpha = \frac{X - 40}{S}$$

At and beyond the frequencies  $\pm B(-X \text{ dB})/2$  from  $F_0$ , the level shall be at least the dB value below the maximum spectral power density given by:

$$X(\text{dB}) = 60\text{dB} \text{ or } X(\text{dB}) = P_t + 30$$

whichever is the greater attenuation.

All harmonic frequencies shall be at a level that is at least 60 dB below the maximum spectral power density.

NOTE:  $P_t$  may be measured or may for the purpose of these criteria be calculated from the following:<sup>21</sup>

$$\text{Eq.13: } P_t = P_p + 20 \log(N * t) + 10 \log(PRR) - PG - 90$$

where  $PG = 0$ , for non-FM, non-encoded pulse radars

$PG = 10 \log(d)$ , for FM pulse radars, where  $d$  = pulse compression ratio = emitted pulse duration/compressed pulsed duration (at 50% amplitude points).

$PG = 10 \log(N)$ , for coded pulse radars, where  $N$  = total number of chips (subpulses) contained in the pulse. ( $N = 1$  for non-FM and FM pulse radars.)

### Criteria E Permitted EIRP

The EIRP<sup>22</sup> of any WPR operating at 449 MHz shall not exceed the following values:

for	45 < elevation angle < 60 deg	78 dBm	90 dBm
for	5 < elevation angle < 45 deg	73 dBm	85 dBm
for	elevation angle < 5 deg	58 dBm	70 dBm

### Criteria E WPR Receiver

The -3 dB receiver bandwidth should be commensurate with the authorized emission bandwidth plus twice the transmitter frequency tolerance of 10 ppm (as specified in Section 5.2.1). The -60 dB receiver bandwidth shall be

<sup>21</sup> Although this equation seems incorrect to have 10 and 20 log terms in it, the equation is correct. In essence it makes the X(dB) term lower (more suppression) when the radar's duty cycle increases.

<sup>22</sup> EIRP is the sum of two quantities: peak transmitter power in dBm and antenna gain in dBi. The column labeled Median is based on median antenna gain and the column labeled Maximum is based on maximum antenna gain.

commensurate with the -60 dB emission bandwidth. Receivers shall be capable of switching bandwidth limits to appropriate values whenever the transmitter bandwidth is switched (pulse shape changed). Receiver IF image frequency rejection shall be at least 50 dB. Rejection of other spurious responses shall be at least 60 dB. WPR receivers shall not exhibit any local oscillator radiation greater than -40 dBm at the antenna input terminals.

### **Criteria E EMC Provisions**

WPR's shall have the capacity to tolerate pulsed interference of duty cycles less than 1.5% at the IF output such that peak interfering signal levels 30 dB greater than WPR receiver noise level at the IF output will not degrade WPR performance.

### **Criteria E Measurement Capability**

See paragraph M.2.2.4 of Annex M.

## **5.5.8 Commercial off-the-shelf (COTS) Radar Systems**

1. In cases where government radionavigation radars operate in the shared federal/non-federal bands, there is an acceptable degree of electromagnetic compatibility associated with the radar equipment commercially available to the non-federal community of users. The vast preponderance of the non-federal use of these bands by domestic and foreign ships and commercial aircraft creates a situation where relatively inexpensive commercial equipment is available off-the-shelf. Accordingly, this commercial off-the-shelf (COTS) equipment is not required to meet the more stringent NTIA RSEC standards. Federal agencies may procure COTS equipment; however, federal agencies procuring COTS radars operating in the radiodetermination frequency bands shall comply with FCC standards required for commercially available equipment as defined in 47 CFR, Part 80 Sub-Parts E, F, and M regarding maritime radars and Part 87 Sub-Part D regarding aviation radars. The following services and bands are affected:

- a. Maritime radionavigation radars in the bands 2900-3100 MHz, 5470-5650 MHz, and 9200-9500 MHz;
  - b. Airborne aeronautical weather, windshear, and radionavigation radars in the bands 5350-5470, 8750-8850, 9300-9500, 13250-13400, and 15400-15700 MHz; and
  - c. Radar altimeters in the band 4200-4400 MHz.
2. This regulation is for COTS radionavigation radars procured after October 1, 2020.
3. The agencies must comply with the following criteria:
- a. Federal agencies shall only procure equipment which has been approved by the FCC for use in the United States.
  - b. Federal agencies must use the system as it was marketed and shall not modify the equipment in any way that would invalidate the FCC equipment compliance certifications. If federal agencies modify a COTS radar system, the radar system will be required to meet applicable NTIA RSEC standards.
  - c. Federal agencies shall only use this COTS equipment for the purpose for which it is marketed.
4. The standards and applicability of these regulations will be re-examined if there are any changes to the allocation and/or operational status in these bands.

## **5.6 Space Services**

### **5.6.1 General**

1. These requirements are applicable to federal space systems including associated earth terminals and space stations operating in portions of the spectrum allocated to the space services above 470 MHz. They do not apply to transmissions from radars on the ground or aboard spacecraft. Standards for radars aboard spacecraft are contained in Section 5.5. Standards for Earth and space stations operating in bands below 470 MHz are contained in Section 5.2.

2. For planning and evaluation purposes this standard cannot be used alone. Modulation type, emission spectrum, power output, frequency tolerance, and maximum expected Doppler shift should be considered and provided in accordance with Chapter 10 of this Manual.

3. The requirements of this standard do not apply to deep space spacecraft transmitters while operating at distances greater than 2,000,000 km from Earth, in those frequency bands allocated to space research (space-to-

earth) (Deep Space Only). This exemption of deep space spacecraft transmitters from unwanted emissions standards will be reviewed every 5 years, beginning in the year 2005. Such a review will take account of radio astronomy requirements (see RR 22.22-22.25), as soon as radio astronomy activities on the Shielded Zone of the Moon, or in Deep Space get under way.

## 5.6.2 Unwanted Emission Mask

For frequencies offset from the assigned frequency less than the 50% of the necessary bandwidth ( $B_n$ ), no attenuation is required. At a frequency offset equal to 50% of the necessary bandwidth, an attenuation of at least 8 dB is required. Frequencies offset more than 50% of the necessary bandwidth should be attenuated by the following mask:

$$40 \times \log \left( \frac{2 \times |f_d|}{B_n} \right) + 8 \text{ dBsd}$$

where  $f_d$  is the frequency displaced from the center of the emission bandwidth.

- a. Annex J gives procedures for determining  $B_n$ .
- b. dBsd is dB attenuation in a 4 kHz bandwidth, relative to the maximum power in any 4 kHz bandwidth within the necessary bandwidth (0dBsd). Above 15 GHz, a 1 MHz bandwidth may be used.
- c. Attenuation in this sense refers to the reduction in level relative to the reference, 0 dBsd, unless otherwise specified.
- d. The unwanted emission mask rolls off at 40 dB per decade to a maximum attenuation of 60 dBsd, at which point it continues on both sides of the carrier for all frequencies beyond this point. See Figure 5.6.1. Annex M gives measurement requirements. For any narrowband or single frequency unwanted emission which is not spread by the modulation process, the required attenuation shall be at least 60 dBc, where dBc is attenuation below the mean transmit power, rather than the dBsd value determined above.
- e. In the design of systems and operation of stations in the fixed-satellite service (Earth-to-space) in the band 30-31 GHz, agencies are encouraged to take all reasonable steps such that unwanted emission powers do not exceed:

<sup>23</sup>

(1) –9 dBW into the 200 MHz of the Earth exploration-satellite service (passive) band 31.3-31.5 GHz for earth stations having an antenna gain greater than or equal to 56 dBi; and

(2) –20 dBW into the 200 MHz of the Earth exploration-satellite service (passive) band 31.3-31.5 GHz for earth stations having an antenna gain less than 56 dBi.

## 5.6.3 Multi-Carrier Emissions and Multi-Transponder Satellites

Multi-carrier transmitters/transponders are those where multiple carriers may be transmitted simultaneously from a final amplifier or an active antenna. For systems with multiple carriers, the limit on unwanted emissions should start at the edges of the total assigned bandwidth. For satellite systems, the necessary bandwidth used in the masks in 5.6.2 should be taken to be the lesser of 3 dB transponder bandwidth or the total assigned bandwidth. This bandwidth applies even when some of the carriers are not transmitted continuously, or when some carriers change in frequency. More information on unwanted emission masks for multi-carrier and multi-transponder systems can be found in ITU-R Recommendation SM.1541 and Appendix 3 to the ITU-R Radio Regulations.

## 5.6.4 Unwanted Emissions from One Transponder Falling Within the Frequency Band of Another Transponder on the Same Satellite

A single satellite operating with more than one transponder in the same service area may have unwanted emissions from one transponder falling on a frequency at which a second companion transponder is transmitting. The limits should not be applied to those unwanted emissions of a satellite that fall within the necessary emission

<sup>23</sup> These recommended maximum levels apply under clear-sky conditions. During fading conditions, these levels may be exceeded by earth stations when using uplink power control.

bandwidth of another transponder, on the same satellite, into the same service area.

### 5.6.5 Narrow Band Emissions

In the case of very narrow-band emissions where the necessary bandwidth is less than the minimum bandwidth ( $B_L$ ) given in Table 5.6.1,  $B_L$  shall be used in place of  $B_n$  in Section 5.6.2 above. Examples include beacons, pilots and other unmodulated carriers.

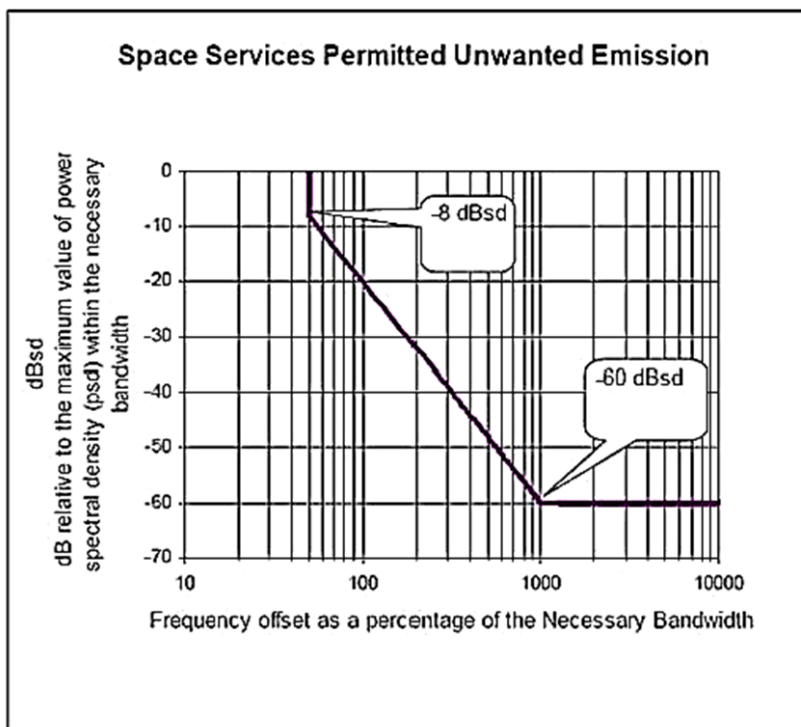
### 5.6.6 Table 5.6.1 Minimum Bandwidth

Table 5.6.1 Minimum Bandwidth	
Operating Frequency Range ( $f_c$ )	Minimum Bandwidth ( $B_L$ )
470 MHz $< f_c < 1$ GHz	25 kHz
1 GHz $< f_c < 10$ GHz	100 kHz
10 GHz $< f_c < 15$ GHz	300 kHz
15 GHz $< f_c < 26$ GHz	500 kHz
$f_c > 26$ GHz	1 MHz

In Table 5.6.1,  $f_c$  is the center frequency of the emission. If the assigned frequency band of the emissions extends across two frequency ranges, then the values corresponding to the higher frequency range may be used for the whole assignment.

Figure 5-12

### Maximum Unwanted Emission Levels for Space Services



(Last Page in Chapter 5)

## Chapter 6

### Definitions and Particulars of Assignments

#### 6.1 DEFINITIONS

##### 6.1.1 Special Terms (General)

Where a definition is followed by the parenthetical expression “(RR),” it is an indication the definition is in the ITU Radio Regulations.

**Accepted Interference:**<sup>1</sup> Interference at a higher level than that defined as permissible interference, and which has been agreed upon between two or more administrations without prejudice to other administrations. (RR)

**Active Satellite:** A satellite carrying a station intended to transmit or retransmit radiocommunication signals. (RR)

**Active Sensor:** A measuring instrument in the Earth exploration-satellite service or in the space research service by means of which information is obtained by transmission and reception of radio waves. (RR)

**Adaptive System:** A radiocommunication system which varies its radio characteristics according to channel quality (RR).

**Administration:** Any governmental department or service responsible for discharging the obligations undertaken in the Constitution of the International Telecommunication Union, in the Convention of the International Telecommunication Union and in the Administrative Regulations. (RR)

**Aeronautical Advisory Station:** An aeronautical station used for advisory and civil defense communications primarily with private aircraft stations. Also called UNICOM Stations.

**Aeronautical Broadcast Station:** An aeronautical station which makes scheduled broadcasts of meteorological information and notices to airmen. (In certain instances, an aeronautical broadcast station may be placed on board a ship.)

**Aeronautical Earth Station:** An Earth Station in the fixed-satellite service, or, in some cases, in the aeronautical mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service. (RR)

**Aeronautical Marker Beacon Station:** A radionavigation land station in the aeronautical radionavigation service which employs a marker beacon.

**Aeronautical Mobile Service:** A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate; emergency position-indicating radiobeacon stations may also participate in this service on designated distress and emergency frequencies. (RR)

**Aeronautical Mobile (OR)<sup>2</sup> Service:** An aeronautical mobile service intended for communications, including those relating to flight coordination, primarily outside national or international civil air routes. (RR)

**Aeronautical Mobile (R)<sup>3</sup> Service:** An aeronautical mobile service reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes. (RR)

**Aeronautical Mobile-Satellite Service:** A mobile-satellite service in which mobile earth stations are located on board aircraft; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. (RR)

**Aeronautical Mobile-Satellite (OR)<sup>2</sup> Service:** An aeronautical mobile-satellite service intended for communications, including those relating to flight coordination, primarily outside national and international civil air routes. (RR)

**Aeronautical Mobile-Satellite (R)<sup>3</sup> Service:** An aeronautical mobile-satellite service reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes. (RR)

**Aeronautical Mobile-Satellite Space Station:** A space station in the aeronautical mobile-satellite service.

**Aeronautical Radiobeacon Station:** A radiobeacon station in the aeronautical radionavigation service intended for the benefit of aircraft.

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<sup>1</sup> The terms “permissible” and “accepted interference” are used in the coordination of frequency assignments between administrations. (RR)

<sup>2</sup> (OR): off-route (RR)

<sup>3</sup> (R): route (RR)

**Aeronautical Radionavigation-Satellite Earth Station:** An fixed earth station in the aeronautical radionavigation-satellite service.

**Aeronautical Radionavigation-Satellite Mobile Earth Station:** A mobile earth station in the aeronautical radionavigation-satellite service.

**Aeronautical Radionavigation-Satellite Service:** A radionavigation-satellite service in which earth stations are located on board aircraft. (RR)

**Aeronautical Radionavigation Service:** A radionavigation service intended for the benefit and for the safe operation of aircraft. (RR)

**Aeronautical Radionavigation-Satellite Space Station:** A space station in the aeronautical radionavigation-satellite service.

**Aeronautical Station:** A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea. (RR)

**Aeronautical Telemetry Land Station:** A telemetry land station used in the flight testing of manned or unmanned aircraft, missiles, or major components thereof.

**Aeronautical Telemetry Mobile Station:** A telemetry mobile station used for transmitting data directly related to the airborne testing of the vehicle (or major components), on which the station is installed.

**Aeronautical Utility Land Station:** A land station located at airdrome control towers and used for control of ground vehicles and aircraft on the ground at airdromes.

**Aeronautical Utility Mobile Station:** A mobile station used for communication at airdromes with the aeronautical utility land station, the airdrome control station, the FAA flight service station, ground vehicles, and aircraft on the ground. (All transmissions shall be subject to the control of the airdrome control station and shall be discontinued immediately when so requested by the airdrome control operators.)

**Aircraft Earth Station:** A mobile earth station in the aeronautical mobile-satellite service located on board an aircraft. (RR)

**Aircraft Station:** A mobile station in the aeronautical mobile service, other than a survival craft station, located on board an aircraft. (RR)

**Airdrome Control Station:** An aeronautical station providing communication between an airdrome control tower and aircraft.

**Allocation (of a frequency band):** Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more (terrestrial or space) radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned. (RR)

**Allotment (of a radio frequency or radio frequency channel):** Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions. (RR)

**Altimeter Station:** A radionavigation mobile station in the aeronautical radionavigation service which employs a radio altimeter.

**Altitude of the Apogee or of the Perigee:** The altitude of the apogee or perigee above a specified reference surface serving to represent the surface of the Earth. (RR)

**Amateur-Satellite Service:** A radiocommunication service using space stations on earth satellites for the same purposes as those of the amateur service. (RR)

**Amateur Service:** A radiocommunication service for the purpose of self-training, intercommunication and technical investigation carried out by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest. (RR)

**Amateur Station:** A station in the amateur service. (RR)

**ASDE:** A radiolocation device employed for airport surface surveillance.

**Assigned Frequency:** The center of the frequency band assigned to a station. (RR)

**Assigned Frequency Band:** The frequency band within which the emission of a station is authorized; the width of the band equals the necessary bandwidth plus twice the absolute value of the frequency tolerance. Where space stations are concerned, the assigned frequency band includes twice the maximum Doppler shift that may occur in relation to any point of the Earth's surface. (RR)

**Assignment (of a radio frequency or radio frequency channel):** Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions. (RR)

**Authorized Bandwidth:** Authorized bandwidth is, for purposes of this Manual, the necessary bandwidth (bandwidth required for transmission and reception of intelligence) and does not include allowance for transmitter drift or Doppler shift.



**Aviation Instructional Station:** A land or mobile station in the aeronautical mobile service used for radiocommunications pertaining to instructions to students or pilots while actually operating aircraft or engaged in soaring activities.

**Base Earth Station:** An earth station in the fixed-satellite service or, in some cases, in the land mobile-satellite service, located at a specified fixed point or within a specified area on land to provide a feeder link for the land mobile-satellite service. (RR)

**Base Station:** A land station in the land mobile service. (RR)

**Bridge-to-Bridge Station:** A ship station operating in the port operations service in which messages are restricted to navigational communications and which is capable of operation from the ship's navigational bridge or, in the case of a dredge, from its main control station, operating on a frequency or frequencies in the 156-162 MHz band.

**Broadcasting-Satellite Service:** A radiocommunication service in which signals transmitted or retransmitted by space stations are intended for direct reception by the general public. In the broadcasting-satellite service, the term “direct reception” shall encompass both individual reception and community reception. (RR)

**Broadcasting-Satellite Space Station:** A space station in the broadcasting-satellite service (television).

**Broadcasting Service:** A radiocommunication service in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, television transmissions or other types of transmissions. (RR)

**Broadcasting Station:** A station in the broadcasting service. (RR)

**Carrier Power (of a radio transmitter):** The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle taken under the condition of no modulation. (RR)

**Characteristic Frequency:** A frequency which can be easily identified and measured in a given emission. A carrier frequency may, for example, be designated as the characteristic frequency. (RR) (See also Reference Frequency.)

**Chip-Rate:** The rate of encoding.

**Class of Emission:** The set of characteristics of an emission, designated by standard symbols, e.g., type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also if appropriate, any additional signal characteristics. (RR)

**Coast Earth Station:** An earth station in the fixed-satellite service or, in some cases, in the maritime mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the maritime mobile-satellite service. (RR)

**Coast Station:** A land station in the maritime mobile service. (RR)

**Coded Squelch:** A system wherein radio receivers are equipped with devices which allow audio signals to appear at the receiver output only when a carrier modulated with a specific signal is received.

**Cognitive Radio System:** A radiocommunication system that is aware of its environment and internal state and can make decisions about, and adjust, its operating characteristics based on information and predefined objectives.

**Community Reception (in the broadcasting-satellite service):** The reception of emissions from a space station in the broadcasting-satellite service by receiving equipment, which in some cases may be complex and have antennae larger than those used for individual reception, and intended for use:

- by a group of the general public at one location; or
- through a distribution system covering a limited area. (RR)

**Conterminous United States:** The term “Conterminous United States” includes the 48 contiguous States and the District of Columbia. (See also definitions for “United States” and “United States and Possessions.”)

**Coordination Area:** The area associated with an earth station outside of which a terrestrial station sharing the same frequency band neither causes nor is subject to interfering emissions greater than a permissible level. (RR)

**Coordination Contour:** The line enclosing the coordination area. (RR)

**Coordination Distance:** Distance on a given azimuth from an earth station beyond which a terrestrial station sharing the same frequency band neither causes nor is subject to interfering emissions greater than a permissible level. (RR)

**Coordinated Universal Time (UTC):** Time scale, based on the second (SI), as defined in ITU-R recommendation ITU-R TF.460-6. (RR)

**Deep Space:** Space at distances from the Earth equal to or greater than  $2 \times 10^6$  kilometers. (RR)

**Direct Sequence Spread Spectrum:** A signal structuring technique utilizing a digital code sequence having a chip rate much higher than the information signal bit rate. Each information bit of a digital signal is transmitted as a pseudo-random sequence of chips.

**Distance Measuring Equipment (DME):** Equipment that ascertains the distance of an interrogator from a transponder by measuring the time of transmission to and from the transponder.

**Duplex Operation:** Operating method in which transmission is possible simultaneously in both directions of a telecommunication channel.<sup>4</sup> (RR)

**Dynamic Spectrum Access:** The real-time adjustment of spectrum utilization in response to changing circumstances and objectives.

**Earth Exploration-Satellite Earth Station:** An earth station in the Earth exploration-satellite service.

**Earth Exploration-Satellite Service:** A radiocommunication service between earth stations and one or more space stations, which may include links between space stations, in which:

information relating to the characteristics of the Earth and its natural phenomena including data relating to the state of the environment is obtained from active sensors or passive sensors on earth satellites;

- similar information is collected from airborne or Earth-based platforms;
- such information may be distributed to earth stations within the system concerned;
- platform interrogation may be included.

This service may also include feeder links necessary for its operation. (RR)

**Earth Exploration-Satellite Space Station:** A space station in the Earth exploration-satellite service.

**Earth Station:** A station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication:

- with one or more space stations; or
- with one or more stations of the same kind by means of one or more reflecting satellites or other objects in space. (RR)

**Effective Antenna Gain Contour (of a steerable satellite beam):** An envelope of antenna gain contours resulting from moving the boresight of a steerable satellite beam along the limits of the effective boresight area. (RR)

**Effective Boresight Area (of a steerable satellite beam):** An area on the surface of the Earth within which the boresight of a steerable satellite beam is intended to be pointed. There may be more than one unconnected effective boresight area to which a single steerable satellite beam is intended to be pointed. (RR)

**Effective Monopole Radiated Power (e.m.r.p.) (in a given direction):** The product of the power supplied to the antenna and its gain relative to a short vertical antenna in a given direction. (RR)

**Effective Radiated Power (e.r.p.) (in a given direction):** The product of the power supplied to the antenna and its gain relative to a halfwave dipole in a given direction. (RR)

**Electromagnetic Compatibility (EMC):** Electromagnetic compatibility is the condition which prevails when telecommunications equipment is performing its individually designed function in a common electromagnetic environment without causing or suffering unacceptable degradation due to unintentional electromagnetic interference to or from other equipment in the same environment.

**Emergency locator transmitter (ELT):** A transmitter of an aircraft or survival craft actuated manually or automatically that is used as an alerting and locating aid for survival purposes.

**Emergency Position-Indicating Radiobeacon Station:** A station in the mobile service the emissions of which are intended to facilitate search and rescue operations. (RR)

**Emission:** Radiation produced, or the production of radiation, by a radio transmitting station. For example, the energy radiated by the local oscillator of a radio receiver would not be an emission but a radiation. (RR)

**Environmental Communications:** Communications in the maritime mobile service for the broadcast of information pertaining to the environmental conditions in which vessels operate (i.e., weather, sea conditions, time signals of a grade adequate for practical navigation, notices to mariners and hazards to navigation).

**Equivalent Isotropically Radiated Power (e.i.r.p.):** The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain). (RR)

**Equivalent Satellite Link Noise Temperature:** The noise temperature referred to the output of the receiving antenna of the earth station corresponding to the radio frequency noise power which produces the total observed noise at the output of the satellite link excluding noise due to interference coming from satellite links using other satellites and from terrestrial systems. (RR)

**Expendable Launch Vehicle (ELV):** A booster rocket that can be used only once to launch a payload, such as a missile or space vehicle.

**Experimental Composite Station:** An experimental station used in experimental operations of a complex nature not readily specified or used in operation which is a composite of two or more of the established experimental categories.

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<sup>4</sup> In general, duplex operation and semi-duplex operation require two frequencies in radiocommunications; simplex operation may use either one or two. (RR)

**Experimental Contract Developmental Station:** An experimental station used for the evaluation or testing under federal government contract of electronics equipment or systems in a design or development stage.

**Experimental Developmental Station:** An experimental station used for evaluation or testing of electronics equipment or systems in a design or development stage.

**Experimental Export Station:** An experimental station intended for export and used for the evaluation or testing of electronics equipment or systems in the design or development stage.

**Experimental Research Station:** An experimental station used in basic studies concerning scientific investigations looking toward the improvement of the art of radiocommunications.

**Experimental Station:** A station utilizing radio waves in experiments with a view to the development of science or technique. This definition does not include amateur stations. (RR)

**Experimental Testing Station:** An experimental station used for the evaluation or testing of electronics equipment or systems, including site selection and transmission path surveys, which have been developed for operational use.

**Facsimile:** A form of telegraphy for the transmission of fixed images, with or without half-tones, with a view to their reproduction in a permanent form. (RR)

**Feeder Link:** A radio link from an earth station at a given location to a space station, or vice versa, conveying information for a space radiocommunication service other than for the fixed-satellite service. The given location may be at a specified fixed point, or at any fixed point within specified areas. (RR)

**Field-Disturbance Sensor:** A restricted radiation device which establishes a radio frequency field in its vicinity and detects changes in that field resulting from the movement of persons or objects within the radio frequency field. Examples: microwave intrusion sensors; devices that use RF energy for production line counting and sensing.

**Fixed Earth Station:** An earth station intended to be used at a specified fixed point.

**Fixed-Satellite Earth Station:** An earth station in the fixed-satellite service.

**Fixed-Satellite Service:** A radiocommunication service between earth stations at given positions when one or more satellites are used; the given position may be a specified fixed point or any fixed point within specified areas; in some cases this service includes satellite-to-satellite links, which may also be operated in the inter-satellite service, the fixed-satellite service may also include feeder links for other space radiocommunication services. (RR)

**Fixed-Satellite Space Station:** A space station in the fixed-satellite service.

**Fixed Service:** A radiocommunication service between specified fixed points. (RR)

**Fixed Station:** A station in the fixed service. (RR)

**Flight Telemetry Land Station:** A telemetry land station the emissions of which are used for telemetry to a balloon; to a booster or rocket, excluding a booster or rocket in orbit about the Earth or in deep space; or to an aircraft, excluding a station used in the flight testing of an aircraft.

**Flight Telemetry Mobile Station:** A telemetry mobile station used for transmitting data from an airborne vehicle, excluding data related to airborne testing of the vehicle itself, (or major components thereof).

**Flight Termination:** An emergency action taken by range safety when a vehicle violates established safety criteria for the protection of life and property. This action circumvents the vehicles' normal control modes and ends its powered and/or controlled flight. This action may include any one or a combination of the following:

- a. Complete vehicle destruction by explosive means.
- b. Aerodynamic disruption of the flight mechanism.
- c. Deployment of high drag devices.
- d. Fuel cut-off to the combustion chambers of ignited motors.
- e. Inhibit ignition of unburned motors.
- f. Other special actions dictated by the vehicle configuration or special problems.

These actions may be activated by manual, computerized, and/or automatic modes.

**Flight Test Station:** An aeronautical station used for the transmission of essential communications in connection with the testing of aircraft or major components of aircraft.

**Frequency-Hopping Spread Spectrum:** A signal structuring technique employing automatic switching of the transmitted frequency. Selection of the frequency to be transmitted is typically made in a pseudo-random manner from a set of frequencies covering a band wider than the information band-width. The intended receiver would frequency-hop in synchronization with the code of the transmitter in order to retrieve the desired information.

**Frequency Sharing:** The common use of the same portion of the radio frequency spectrum by two or more users where a probability of interference exists.

**Frequency-Shift Telegraphy:** Telegraphy by frequency modulation in which the telegraph signal shifts the frequency of the carrier between predetermined values. (RR)

**Frequency Tolerance:** The maximum permissible departure by the center frequency of the frequency band occupied by an emission from the assigned frequency or, by the characteristic frequency of an emission from the reference frequency. The frequency tolerance is expressed in parts in 10<sup>6</sup> or in Hertz. (RR)

**Full Carrier Single-Sideband Emission:** A single-sideband emission without reduction of the carrier. (RR)

**Gain of an Antenna:** The ratio, usually expressed in decibels, of the power required at the input of a loss free reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength or the same power flux-density at the same distance. When not specified otherwise, the gain refers to the direction of maximum radiation. The gain may be considered for a specified polarization. Depending on the choice of the reference antenna a distinction is made between:

- absolute or isotropic gain ( $G_i$ ), when the reference antenna is an isotropic antenna isolated in space;
- gain relative to a half-wave dipole ( $G_d$ ), when the reference antenna is a half-wave dipole isolated in space whose equatorial plane contains the given direction;
- gain relative to a short vertical antenna ( $G_v$ ), when the reference antenna is a linear conductor, much shorter than one quarter of the wavelength, normal to the surface of a perfectly conducting plane which contains the given direction. (RR)

**Geostationary Satellite:** A geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator and which thus remains fixed relative to the Earth; by extension, a geosynchronous satellite which remains approximately fixed relative to the Earth. (RR)

**Geostationary Satellite Orbit:** The orbit of a geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator. (RR)

**Geosynchronous Satellite:** An earth satellite whose period of revolution is equal to the period of rotation of the Earth about its axis. (RR)

**Glide Path (Slope) Station:** A radionavigation land station which provides vertical guidance to aircraft during approach to landing.

**Government Master File (GMF):** The central database repository containing the complete and authoritative listing of Federal Government frequency assignments along with additional records included for spectrum management, analysis, coordination, and information purposes.

**Harmful Interference:** Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with these regulations. (RR)

**Hertz:** A unit of frequency which is equivalent to one cycle per second.

**Hybrid Spread Spectrum:** A combination of Frequency Hopping Spread Spectrum and Direct Sequence Spread Spectrum.

**Hydrologic and Meteorological Fixed Station:** A fixed station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**Hydrologic and Meteorological Land Station:** A land station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**Hydrologic and Meteorological Mobile Station:** A mobile station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**Incidental Radiation Device:** A device that radiates radio frequency energy during the course of its operation although the device is not intentionally designed to generate radio frequency energy.

**Inclination of an Orbit (of an earth satellite):** The angle determined by the plane containing the orbit and the plane of the Earth's equator. (RR)

**Individual Reception (in the broadcasting-satellite service):** The reception of emissions from a space station in the broadcasting-satellite service by simple domestic installations and in particular those possessing small antennae. (RR)

**Industrial Heating Equipment:** Any apparatus which utilizes a radio frequency oscillator or any other type of radio frequency generator and transmits radio frequency energy used for or in connection with industrial heating operations utilized in a manufacturing or production process.

**Industrial, Scientific and Medical (ISM) Applications (of radio frequency energy):** Operation of equipment or appliances designed to generate and use locally radio frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunications. (RR)

**Instrument Landing System (ILS):** A radionavigation system which provides aircraft with horizontal and vertical guidance just before and during landing and, at certain fixed points, indicates the distance to the reference point of landing. (RR)

**Instrument Landing System Glide Path:** A system of vertical guidance embodied in the instrument landing system which indicates the vertical deviation of the aircraft from its optimum path of descent. (RR)

**Instrument Landing System Localizer:** A system of horizontal guidance embodied in the instrument landing system which indicates the horizontal deviation of the aircraft from its optimum path of descent along the axis of the runway. (RR)

**Interference:** The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy. (RR)

**International Broadcasting Station:** A broadcasting station, employing frequencies allocated to the broadcasting service between 5950 kHz and 26100 kHz, whose transmissions are intended to be received directly by the general public in foreign countries.

**Inter-Satellite Service:** A radiocommunication service providing links between artificial earth satellites. (RR)

**Inter-Satellite Space Station:** A space station in the inter-satellite service.

**Ionosphere Sounder:** A device that transmits signals for the purpose of determining ionospheric conditions.

**Ionospheric Scatter:** The propagation of radio waves by scattering as a result of irregularities or discontinuities in the ionization of the ionosphere. (RR)

**Land Earth Station:** An earth station in the fixed-satellite service or, in some cases, in the mobile-satellite service, located at a specified fixed point or within a specified area on land to provide a feeder link for the mobile-satellite service. (RR)

**Land Mobile Earth Station:** A mobile earth station in the land mobile-satellite service capable of surface movement within the geographical limits of a country or continent. (RR)

**Land Mobile-Satellite Service:** A mobile-satellite service in which mobile earth stations are located on land. (RR)

**Land Mobile-Satellite Space Station:** A space station in the land mobile-satellite service.

**Land Mobile Service:** A mobile service between base stations and land mobile stations, or between land mobile stations. (RR)

**Land Mobile Station:** A mobile station in the land mobile service capable of surface movement within the geographical limits of a country or continent. (RR)

**Land Station:** A station in the mobile service not intended to be used while in motion. (RR)

**Left-Hand (or Anti-Clockwise) Polarized Wave:** An elliptically or circularly-polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a left-hand or anticlockwise direction. (RR)

**Localizer Station:** A radionavigation land station in the aeronautical radionavigation service which employs an Instrument Landing System Localizer.

**Loran Station:** A long distance radionavigation land station transmitting synchronized pulses. Hyperbolic lines of position are determined by the measurement of the difference in the time of arrival of these pulses.

**Low-Power Communication Device:** A restricted radiation device, exclusive of those employing conducted or guided radio frequency techniques, used for the transmission of signs, signals (including control signals), writing, images and sounds or intelligence of any nature by radiation of electromagnetic energy. Examples: Wireless microphone, phonograph oscillator, radio-controlled garage door opener, and radio-controlled models.

**Marine Broadcast Station:** A coast station which makes scheduled broadcasts of time, meteorological, and hydrographic information.

**Marine Radiobeacon Station:** A radiobeacon station in the maritime radionavigation service intended for the benefit of ships.

**Maritime Mobile-Satellite Service:** A mobile-satellite service in which mobile earth stations are located on board ships; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. (RR)

**Maritime Mobile-Satellite Space Station:** A space station in the maritime mobile-satellite service.

**Maritime Mobile Service:** A mobile service between coast stations and ship stations, or between ship stations, or between associated on-board communication stations; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. (RR)

**Maritime Radionavigation-Satellite Earth Station:** An fixed earth station in the maritime radionavigation-satellite service.

**Maritime Radionavigation-Satellite Mobile Earth Station:** A mobile earth station in the maritime radionavigation-satellite service.

**Maritime Radionavigation-Satellite Service:** A radionavigation-satellite service in which earth stations are located on board ships. (RR)

**Maritime Radionavigation-Satellite Space Station:** A space station in the maritime radionavigation-satellite service.

**Maritime Radionavigation Service:** A radionavigation service intended for the benefit and for the safe operation of ships. (RR)

**Marker Beacon:** A transmitter in the aeronautical radionavigation service which radiates vertically a distinctive pattern for providing position information to aircraft. (RR)

**Mean Power (of a radio transmitter):** The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions. (RR)

**Medical Diathermy Equipment:** Any apparatus (other than surgical diathermy apparatus designed for intermittent operation with low power), which utilizes a radio frequency oscillator or any other type of radio frequency generator and transmits radio frequency energy used for therapeutic purposes.

**Meteor Burst Communications:** Communications by the propagation of radio signals reflected by ionized meteor trails.

**Meteorological Aids Service:** A radiocommunication service used for meteorological, including hydrological, observations and exploration. (RR)

**Meteorological Radar Station:** A station in the meteorological aids service employing radar.

**Meteorological-Satellite Earth Station:** An earth station in the meteorological-satellite service.

**Meteorological-Satellite Service:** An Earth exploration-satellite service for meteorological purposes. (RR)

**Meteorological-Satellite Space Station:** A space station in the meteorological-satellite service.

**Miscellaneous ISM Equipment:** Any apparatus other than that defined as medical diathermy equipment or industrial heating equipment, or otherwise excepted by those definitions, in which radio frequency energy is applied to materials to produce physical, biological, or chemical effects such as heating, ionization of gases, mechanical vibrations, hair removal, and acceleration of charged particles, which do not involve communications or the use of radio receiving equipment.

**Mobile Earth Station:** An earth station in the mobile-satellite service intended to be used while in motion or during halts at unspecified points. (RR)

**Mobile-Satellite Service:** A radiocommunication service:

- between mobile earth stations and one or more space stations, or between space stations used by this service; or
- between mobile earth stations by means of one or more space stations.

This service may also include feeder links necessary for its operation. (RR)

**Mobile-Satellite Space Station:** A space station in the mobile-satellite service.

**Mobile Service:** A radiocommunication service between mobile and land stations, or between mobile stations. (RR)

**Mobile Station:** A station in the mobile service intended to be used while in motion or during halts at unspecified points. (RR)

**Multi-Function System:** A system that provides for more than one type of telecommunication with the same equipment. This system can have one or more principal functions and may have one or more secondary functions contained within the signal format or structure. The signal structure technique can be either of a conventional or spread spectrum type.

**Multi-Satellite Link:** A radio link between a transmitting earth station and a receiving earth station through two or more satellites, without any intermediate earth station. A multi-satellite link comprises one up-link, one or more satellite-to-satellite links and one downlink. (RR)

**Necessary Bandwidth:** For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions. (RR) (See Annex J for formulas used to calculate necessary bandwidth.)

**Non-Interference Basis (NIB):** A condition of use relative to other specified uses that affords no protection from harmful interference from the other specified users, and prohibits causing harmful interference to the other specified users.

**Occupied Bandwidth:** The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage  $\beta/2$  of the total mean power of a given emission.

Unless otherwise specified by the ITU-R Recommendation for the appropriate class of emission, the value of  $\beta/2$  should be taken as 0.5%. (RR)

**Oceanographic Data Interrogating Station:** A station in the maritime mobile service the emissions of which are used to initiate, modify or terminate functions of equipment directly associated with an oceanographic data station, including the station itself.

**Oceanographic Data Station:** A station in the maritime mobile service located on a ship, buoy, or other sensor platform the emissions of which are used for transmission of oceanographic data.

**Omnidirectional Range Station:** A radionavigation land station in the aeronautical radionavigation service providing direct indication of the bearing (omnibearing) of that station from an aircraft.

**On-Board Communication Station:** A low- powered mobile station in the maritime mobile service intended for use for internal communications on board a ship, or between a ship and its lifeboats and life rafts during lifeboat drills or operations, or for communication within a group of vessels being towed or pushed, as well as for line handling and mooring instructions. (RR)

**Orbit:** The path, relative to a specified frame of reference, described by the center of mass of a satellite or other object in space subjected primarily to natural forces, mainly the force of gravity. (RR)

**Out-of-Band Domain (of an emission):** The frequency range, immediately outside the necessary bandwidth but excluding the spurious domain, in which out-of-band emissions generally predominate. Out-of-band emissions, defined based on their source, occur in the out-of-band domain and, to a lesser extent, in the spurious domain. Spurious emissions likewise may occur in the out-of-band domain as well as in the spurious domain. (RR)

**Out-of-band Emission:** Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emission. (RR)

**Passive Sensor:** A measuring instrument in the Earth exploration-satellite service or in the space research service by means of which information is obtained by reception of radio waves of natural origin. (RR)

**Peak Envelope Power (of a radio transmitter):** The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions. (RR)

**Perimeter Protection System:** A field disturbance sensor which uses buried leaky cables installed around a facility to detect any unauthorized entry or exit.

**Period (of a satellite):** The time elapsing between two consecutive passages of a satellite through a characteristic point on its orbit. (RR)

**Permissible Interference:**<sup>5</sup> Observed or predicted interference which complies with quantitative interference and sharing criteria contained in these regulations or in ITU-R recommendations or in special agreements as provided for in these Regulations. (RR)

**Port Operations Service:** A maritime mobile service in or near a port, between coast stations and ship stations, or between ship stations, in which messages are restricted to those relating to the operational handling, the movement and the safety of ships and, in emergency, to the safety of persons. Messages which are of a public correspondence nature shall be excluded from this service. (RR)

**Portable Aircraft Station:** A portable station operating in the aeronautical mobile service.

**Port Station:** A coast station in the port operations service. (RR)

**Portable Land Mobile Station:** A portable station operating in the land mobile service.

**Portable Mobile Station:** A portable station operating in the mobile service.

**Portable Radiolocation Station:** A portable station operating in the radiolocation service.

**Portable Ship Station:** A portable station operating in the maritime mobile service.

**Portable Station:** A station designed to be carried by a person and capable of transmitting and/or receiving while in motion or during brief halts at unspecified locations.

**Power:** Whenever the power of a radio transmitter etc. is referred to it shall be expressed in one of the following forms, according to the class of emission, using the arbitrary symbols indicated:

- peak envelope power (PX or pX);
- mean power (PY or pY);
- carrier power (PZ or pZ).

For different classes of emission, the relationships between peak envelope power, mean power and carrier power, under the conditions of normal operation and of no modulation, are contained in ITU-R Recommendations which may be used as a guide. For use in formulae, the symbol p denotes power expressed in watts and the symbol P denotes power expressed in decibels relative to a reference level. (RR) (See also Carrier Power of a Radio

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<sup>5</sup> The terms “permissible interference” and “acceptable interference” are used in the coordination of frequency assignments between administrations. (RR)

Transmitter, Effective Radiated Power, Mean Power of a Radio Transmitter, and Peak Envelope Power of a Radio Transmitter.)

**Primary Radar:** A radiodetermination system based on the comparison of reference signals with radio signals reflected from the position to be determined. (RR)

**Priority:** Priority, unless specifically qualified, is the right to occupy a specific frequency for authorized uses, free of harmful interference from stations of other agencies.

**Processing Gain:** The ratio of the post processing signal-to-noise ratio to the received signal-to-noise ratio, usually expressed in dB.

**Protection Ratio (R.F.):** The minimum value of the wanted-to-unwanted signal ratio, usually expressed in decibels, at the receiver input determined under specified conditions such that a specified reception quality of the wanted signal is achieved at the receiver output. (RR)

**Public Correspondence:** Any telecommunication which the offices and stations must, by reason of their being at the disposal of the public, accept for transmission. (RR)

**Radar:** A radiodetermination system based on the comparison of reference signals with radio signals reflected, or retransmitted, from the position to be determined. (RR)

**Radar Beacon (racon):** A transmitter-receiver associated with a fixed navigational mark which, when triggered by a radar, automatically returns a distinctive signal which can appear on the display of the triggering radar, providing range, bearing and identification information. (RR)

**Radar Beacon Precipitation Gage Station:** A transponder station in the meteorological aids service, the emissions of which are used for telemetering.

**Radar Beacon (racon) Station:** A station which employs a radar beacon (racon).

**Radar Transponder:** A receiver-transmitter facility the function of which is to transmit signals automatically when proper interrogation is received.

**Radiation:** The outward flow of energy from any source in the form of radio waves. (RR)

**Radio:** A general term applied to the use of radio waves. (RR)

**Radio Altimeter:** Radionavigation equipment, on board an aircraft or spacecraft, used to determine the height of the aircraft or the spacecraft above the Earth's surface or another surface. (RR)

**Radio Astronomy:** Astronomy based on the reception of radio waves of cosmic origin. (RR)

**Radio Astronomy Service:** A service involving the use of radio astronomy. (RR)

**Radio Astronomy Station:** A station in the radio astronomy service. (RR) (This is always a receiving station.)

**Radio Beacon Mobile Station:** A mobile station the emissions of which are used to determine its location.

**Radiobeacon Station:** A station in the radionavigation service the emissions of which are intended to enable a mobile station to determine its bearing or direction in relation to the radiobeacon station. (RR)

**Radiocommunication:** Telecommunication by means of radio waves. (RR)

**Radiocommunication Service:** A service as defined in this section involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes. In these regulations, unless otherwise stated, any radiocommunication service relates to terrestrial radiocommunication. (RR)

**Radiodetermination:** The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves. (RR)

**Radiodetermination-Satellite Earth Station:** An fixed earth station in the radiodetermination-satellite service.

**Radiodetermination-Satellite Mobile Earth Station:** A mobile earth station in the radiodetermination-satellite service.

**Radiodetermination-Satellite Service:** A radiocommunication service for the purpose of radiodetermination involving the use of one or more space stations. This service may also include feeder links necessary for its own operation. (RR)

**Radiodetermination-Satellite Space Station:** A space station in the radiodetermination-satellite service.

**Radiodetermination Service:** A radiocommunication service for the purpose of radiodetermination. (RR)

**Radiodetermination Station:** A station in the radiodetermination service. (RR)

**Radio Direction-Finding:** Radiodetermination using the reception of radio waves for the purpose of determining the direction of a station or object. (RR)

**Radio Direction-Finding Station:** A radiodetermination station using radio direction-finding. (RR)

**Radiolocation:** Radiodetermination used for purposes other than those of radionavigation. (RR)

**Radiolocation Land Station:** A station in the radiolocation service not intended to be used while in motion. (RR)

**Radiolocation Mobile Station:** A station in the radiolocation service intended to be used while in motion or during halts at unspecified points. (RR)



**Radiolocation-Satellite Service:** A radiodetermination-satellite service used for the purpose of radiolocation. This service may also include the feeder links necessary for its operation. (RR)

**Radiolocation Service:** A radiodetermination service for the purpose of radiolocation. (RR)

**Radionavigation:** Radiodetermination used for the purposes of navigation, including obstruction warning. (RR)

**Radionavigation Land Station:** A station in the radionavigation service not intended to be used while in motion. (RR)

**Radionavigation Land Test Station (Maintenance Test Facility):** A radionavigation land station in the aeronautical radionavigation service which is used as a radionavigation calibration station for the transmission of essential information in connection with the testing and calibration of aircraft navigational aids, receiving equipment and interrogators at predetermined surface locations. The primary purpose of this facility is to permit maintenance testing by aircraft radio service personnel.

**Radionavigation Land Test Station (Operational Test Facility):** A radionavigation land station in the aeronautical radionavigation service which is used as a radionavigation calibration station for the transmission of essential information in connection with the testing and calibration of aircraft navigational aids, receiving equipment and interrogators at predetermined surface locations. The primary purpose of this facility is to permit the pilot to check a radionavigation system aboard the aircraft prior to takeoff.

**Radionavigation Mobile Station:** A station in the radionavigation service intended to be used while in motion or during halts at unspecified points. (RR)

**Radionavigation-Satellite Earth Station:** An earth station in the radionavigation-satellite service.

**Radionavigation-Satellite Mobile Earth Station:** A mobile earth station in the radionavigation-satellite service.

**Radionavigation-Satellite Service:** A radiodetermination-satellite service used for the purpose of radionavigation. This service may also include feeder links necessary for its operation. (RR)

**Radionavigation-Satellite Space Station:** A space station in the radionavigation-satellite service.

**Radionavigation Service:** A radiodetermination service for the purpose of radionavigation. (RR)

**Radio Range Station:** A radionavigation land station in the aeronautical radionavigation service providing radial equisignal zones. (In certain instances a radio range station may be placed on board a ship.)

**Radiosonde:** An automatic radio transmitter in the meteorological aids service usually carried on an aircraft, free balloon, kite, or parachute, and which transmits meteorological data. (RR)

**Radiosonde Ground Station:** A station in the meteorological aids service employing a ground station associated with a radiosonde.

**Radiosonde Station:** A station in the meteorological aids service employing a radiosonde.

**Radiotelegram:** A telegram, originating in or intended for a mobile station or a mobile earth station transmitted on all or part of its route over the radiocommunication channels of the mobile service or of the mobile-satellite service. (RR)

**Radiotelemetry:** Telemetry by means of radio waves. (RR)

**Radiotelephone Call:** A telephone call, originating in or intended for a mobile station or a mobile earth station, transmitted on all or part of its route over the radiocommunication channels of the mobile service or of the mobile-satellite service. (RR)

**Radiotelex Call:** A telex call, originating in or intended for a mobile station or a mobile earth station, transmitted on all or part of its route over the radiocommunication channels of the mobile service or the mobile-satellite service. (RR)

**Radio Waves or Hertzian Waves:** Electromagnetic waves of frequencies arbitrarily lower than 3000 GHz, propagated in space without artificial guide. (RR)

**Reduced Carrier Single-Sideband Emission:** A single-sideband emission in which the degree of carrier suppression enables the carrier to be reconstituted and to be used for demodulation. (RR)

**Reference Frequency:** A frequency having a fixed and specific position with respect to the assigned frequency. The displacement of this frequency with respect to the assigned frequency has the same absolute value and sign that the displacement of the characteristic frequency has with respect to the center of the frequency band occupied by the emission. (RR) (See also Characteristic Frequency.)

**Reflecting Satellite:** A satellite intended to reflect radiocommunication signals. (RR)

**Restricted Radiation Device:** A device in which the generation of radio frequency energy is intentionally incorporated into the design, and in which the radio frequency energy is conducted along wires or is radiated, exclusive of transmitters for which provisions are made under those parts of Chapter 7 other than Section 7.9, and exclusive of Industrial, Scientific, and Medical (ISM) equipment.

**Re-usable Launch Vehicle (RLV):** A booster rocket that can be recovered after launch, refurbished, and relaunched.

**Right-Hand (or Clockwise) Polarized Wave:** An elliptically or circularly-polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a right-hand or clockwise direction. (RR)

**RF Stabilized Arc Welder:** Any welding equipment that utilizes radio frequency energy to initiate and stabilize the arc. An RF stabilized arc welder includes the source of the RF and welding currents, the welding torch, and all interconnecting cables.

**Safety Service:** Any radiocommunication service used permanently or temporarily for the safeguarding of human life and property. (RR)

**Satellite:** A body which revolves around another body of preponderant mass and which has a motion primarily and permanently determined by the force of attraction of that other body. (RR)

**Satellite Emergency Position-Indicating Radiobeacon:** An earth station in the mobile-satellite service the emissions of which are intended to facilitate search and rescue operations. (RR)

**Satellite Link:** A radio link between a transmitting earth station and a receiving earth station through one satellite. A satellite link comprises one uplink and one downlink. (RR)

**Satellite Network:** A satellite system or a part of a satellite system, consisting of only one satellite and the cooperating earth stations. (RR)

**Satellite System:** A space system using one or more artificial earth satellites. (RR)

**Secondary Radar:** A radiodetermination system based on the comparison of reference signals with radio signals retransmitted from the position to be determined. (RR)

**Semi-Duplex Operation:** A method which is simplex operation at one end of the circuit and duplex operation at the other. (RR)

**Ship Earth Station:** A mobile earth station in the maritime mobile-satellite service located on board ship. (RR)

**Ship's Emergency Transmitter:** A ship's transmitter to be used exclusively on a distress frequency for distress, urgency, or safety purposes. (RR)

**Ship Movement Service:** A safety service in the maritime mobile service other than a port operations service, between coast stations and ship stations, or between ship stations, in which messages are restricted to those relating to the movement of ships. Messages which are of a public correspondence nature shall be excluded from this service. (RR)

**Ship Station:** A mobile station in the maritime mobile service located on board a vessel which is not permanently moored, other than a survival craft station. (RR)

**Simplex Operation:** Operating method in which transmission is made possible alternately in each direction of a telecommunication channel, for example, by means of manual control. (RR)

**Single-Sideband Emission:** An amplitude modulated emission with one sideband only. (RR)

**Software Defined Radio:** A radio in which radio frequency operating parameters including, but not limited to, frequency range, modulation type, or output power is able to be set or altered by software after the normal installation process.

**Sounder Network Station:** A station equipped with an ionosphere sounder used for the real time selection of frequencies for operational communication circuits.

**Sounder Prediction Station:** A station equipped with an ionosphere sounder for real time monitoring of upper atmosphere phenomena or to obtain data for the prediction of propagation conditions.

**Spacecraft:** A man-made vehicle which is intended to go beyond the major portion of the Earth's atmosphere. (RR)

**Space Operation Earth Station:** An earth station in the space operation service.

**Space Operation Service:** A radiocommunication service concerned exclusively with the operation of spacecraft, in particular space tracking, space telemetry and space telecommand. These functions will normally be provided within the service in which the space station is operating. (RR)

**Space Operation Space Station:** A space station in the space operation service.

**Space Radiocommunication:** Any radiocommunication involving the use of one or more space stations or the use of one or more reflecting satellites or other objects in space. (RR)

**Space Research Earth Station:** An earth station in the space research service.

**Space Research Service:** A radiocommunication service in which spacecraft or other objects in space are used for scientific or technological research purposes. (RR)

**Space Research Space Station:** A space station in the space research service.

**Space Station:** A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere. (RR)

**Space System:** Any group of cooperating earth stations and/or space stations employing space radiocommunication for specific purposes. (RR)

**Space Telecommand:** The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of equipment on an associated space object, including the space station. (RR)

**Space Telecommand Earth Station:** An earth station the emissions of which are used for space telecommand.

**Space Telecommand Space Station:** A space station which receives emissions used for space telecommand.

**Space Telemetry Earth Station:** An earth station which receives emissions used for space telemetry.

**Space Telemetry Space Station:** A space station the emissions of which are used for space telemetry.

**Space Telemetry:** The use of telemetry for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft. (RR)

**Space Tracking:** Determination of the orbit, velocity or instantaneous position of an object in space by means of radiodetermination, excluding primary radar, for the purpose of following the movement of the object. (RR)

**Space Tracking Earth Station:** An earth station which transmits or receives emissions used for space tracking.

**Space Tracking Space Station:** A space station which transmits or receives and retransmits emissions used for space tracking.

**Space Transponder:** A receiver-transmitter combination on board a satellite or space craft which receives a signal and transmits it at a different carrier frequency.

**Special Service:** A radiocommunication service, not otherwise defined in this section, carried on exclusively for specific needs of general utility, and not open to public correspondence. (RR)

**Specialized Mobile Radio Service:** A radio service in which licensees provide land mobile communications services in the 800 MHz and 900 MHz bands on a commercial basis to entities eligible to be licensed under this part, federal government entities, and individuals.

**Spread Spectrum:** A signal structuring technique that employs direct sequence, frequency hopping or a hybrid of these, which can be used for multiple access and/or multiple functions. This technique decreases the potential interference to other receivers while achieving privacy and increasing the immunity of spread spectrum receivers to noise and interference. Spread spectrum generally makes use of a sequential noise-like signal structure to spread the normally narrowband information signal over a relatively wide band of frequencies. The receiver correlates the signals to retrieve the original information signal.

**Spurious Domain (of an emission):** The frequency range beyond the out-of-band domain in which spurious emissions generally predominate. (RR)

**Spurious Emission:** Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions. (RR)

**Squelch:** A circuit function that acts to suppress the audio output of a receiver.

**Standard Frequency and Time Signal Station:** A station in the standard frequency and time signal service. (RR)

**Standard Frequency and Time Signal-Satellite Service:** A radiocommunication service using space stations on earth satellites for the same purpose as those of the standard frequency and time signal service. This service may also include feeder links necessary for its operation. (RR)

**Standard Frequency and Time Signal-Satellite Space Station:** A space station in the standard frequency and time signal-satellite service.

**Standard Frequency and Time Signal Service:** A radiocommunication service for scientific, technical and other purposes, providing the transmission of specified frequencies, time signals, or both, of stated high precision, intended for general reception. (RR)

**Station:** One or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service. Each station shall be classified by the service in which it operates permanently or temporarily. (RR)

**Suppressed Carrier Single-Sideband Emission:** A single-sideband emission in which the carrier is virtually suppressed and not intended to be used for demodulation. (RR)

**Steerable Satellite Beam:** A satellite antenna beam that can be re-pointed. (RR)

**Surface Telemetry Land Station:** A telemetry land station the emission of which are intended to be received on the surface of the Earth.

**Surface Telemetry Mobile Station:** A telemetry mobile station located on the surface of the Earth and the emissions of which are intended to be received on the surface of the Earth.

**Surveillance Radar Station:** A radionavigation land station in the aeronautical radionavigation service employing radar to display the presence of aircraft within its range. (In certain instances, a surveillance radar station may be placed on board a ship.)

**Survival Craft Station:** A mobile station in the maritime mobile service or the aeronautical mobile service intended solely for survival purposes and located on any lifeboat, life raft or other survival equipment. (RR)

**Telecommand:** The use of telecommunication for the transmission of signals to initiate, modify or terminate functions of equipment at a distance. (RR)

**Telecommand Aeronautical Station:** A land station in the aeronautical mobile service the emissions of which are used for terrestrial telecommand.

**Telecommand Aircraft Station:** A mobile station in the aeronautical mobile service the emissions of which are used for terrestrial telecommand.

**Telecommand Base Station:** A land station in the land mobile service the emissions of which are used for terrestrial telecommand.

**Telecommand Coast Station:** A land station in the maritime mobile service the emissions of which are used for terrestrial telecommand.

**Telecommand Fixed Station:** A fixed station in the fixed service the emissions of which are used for terrestrial telecommand.

**Telecommand Land Station:** A land station in the mobile service the emissions of which are used for terrestrial telecommand.

**Telecommand Land Mobile Station:** A mobile station in the land mobile service the emissions of which are used for terrestrial telecommand.

**Telecommand Mobile Station:** A mobile station in the mobile service the emissions of which are used for terrestrial telecommand.

**Telecommand Ship Station:** A mobile station in the maritime mobile service the emissions of which are used for terrestrial telecommand.

**Telecommunication:** Any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems. (RR)

**Telegram:** Written matter intended to be transmitted by telegraphy for delivery to the addressee. This term also includes radiotelegrams unless otherwise specified. In this definition the term telegraphy has the same general meaning as defined in the convention. (RR)

**Telegraphy:** A form of telecommunication in which the transmitted information is intended to be recorded on arrival as a graphic document; the transmitted information may sometimes be presented in an alternative form or may be stored for subsequent use. (RR)

**Telemetry Fixed Station:** A fixed station the emissions of which are used for telemetering.

**Telemetry Land Station:** A land station the emissions of which are used for telemetering.

**Telemetry Mobile Station:** A mobile station the emissions of which are used for telemetering.

**Telemetry:** The use of telecommunication for automatically indicating or recording measurements at a distance from the measuring instrument. (RR)

**Telephony:** A form of telecommunication primarily intended for the exchange of information in the form of speech. (RR)

**Television:** A form of telecommunication for the transmission of transient images of fixed or moving objects. (RR)

**Terrestrial Radiocommunication:** Any radiocommunication other than space radiocommunication or radio astronomy. (RR)

**Terrestrial Station:** A station effecting terrestrial radiocommunication. In these Regulations, unless otherwise stated, any station is a terrestrial station. (RR)

**Time-Gated Direct Sequence Spread Spectrum:** Direct-Sequence Spread Spectrum where the transmitter is on only for a short fraction of a time interval. The on-time can be periodic or random within a time interval.

**Transportable Station:** A station which is transferred to various fixed locations but is not intended to be used while in motion.

**Travelers Information Station:** A base station in the Land Mobile Service used to transmit non-commercial voice information pertaining to traffic and road conditions, traffic hazard and travelers advisories, directions, availability of lodging, rest stops and service stations, and descriptions of local points of interest.

**Tropospheric Scatter:** The propagation of radio waves by scattering as a result of irregularities or discontinuities in the physical properties of the troposphere. (RR)

**Ultrasonic Equipment:** Any apparatus which generates radio frequency energy and utilizes that energy to excite or drive an electro-mechanical transducer for the production of sonic or ultrasonic mechanical energy for industrial, scientific, medical, or other non-communication purposes.

**Ultra-Wideband Radar:** A radar having an instantaneous bandwidth greater than 25 percent of its center frequency.

**United States:** The term "United States" includes the 50 States and the District of Columbia. (See also definition for "Conterminous United States" and "United States and Possessions.")

**United States and Possessions:** The term "United States and Possessions" includes the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, and the territories and possessions (but less the Canal Zone). (See also definitions for "Conterminous United States" and "United States.")

**Unwanted Emissions:** Consist of spurious emissions and out-of-band emissions. (RR)

**War Emergency:**<sup>6</sup> Any condition proclaimed by the President, under the war emergency power granted to him by Section 706 of the Communications Act of 1934, as amended, that affects the national defense or security of the United States.

**Wired Radio Frequency Systems:** Systems employing restricted radiation devices in which the radio frequency energy is conducted or guided along wires or in cables, including electric power and telephone lines.

## 6.1.2 Stations (alphabetical by classes)

1. Where a definition is followed by the parenthetical expression "(RR)," it is an indication that the definition is in the ITU Radio Regulations.

2. The suffix "R" shall be added to the established class of station (STC) symbol only if the station is to be used primarily as a repeater in the bands:

29.89-50.00 MHz (exclusive federal bands)

138.00-144.00 MHz

148.00-149.90 MHz

150.05-150.80 MHz

162.00-174.00 MHz

406.10-420.00 MHz

For this purpose, a repeater consists of a radio transmitter, a radio receiver and coupling between the two so as to retransmit unchanged in intelligence the received signal.

3. The following definitions of Stations and associated Station Class (STC-see Section 9.8.2, Para. 15a. through 15c.) symbols are used on federal frequency assignments as applicable.

**FAB--Aeronautical Broadcast Station:** An aeronautical station which makes scheduled broadcasts of meteorological information and notices to airmen. (In certain instances, an aeronautical broadcast station may be placed on board a ship.)

**TB--Aeronautical Earth Station:** An earth station in the fixed-satellite service or in some cases in the aeronautical mobile-satellite service located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service. (RR)

**ALA--Aeronautical Marker Beacon Station:** A radionavigation land station in the aeronautical radionavigation service which employs a marker beacon.

**EJ--Aeronautical Mobile-Satellite Space Station:** A space station in the aeronautical mobile-satellite service. (RR)

**ALC--Aeronautical Radar Beacon (racon) Station:** A land station in the aeronautical radionavigation service which employs a radar beacon (racon).

**ALB--Aeronautical Radiobeacon Station:** A radiobeacon station in the aeronautical radionavigation service intended for the benefit of aircraft.

**AL--Aeronautical Radionavigation Land Station:** A land station in the aeronautical radionavigation service not intended for use while in motion.

**AM--Aeronautical Radionavigation Mobile Station:** A mobile station in the aeronautical radionavigation service intended to be used while in motion or during halts at unspecified points.

**TZ--Aeronautical Radionavigation-Satellite Earth Station:** A fixed earth station in the aeronautical radionavigation-satellite service.

**TO--Aeronautical Radionavigation-Satellite Mobile Earth Station:** A mobile earth station in the aeronautical radionavigation-satellite service. (RR)

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6 According to Section 706, a war emergency may be proclaimed as a result of:

- (1) war,
- (2) threat of war,
- (3) a state of public peril,
- (4) disaster,
- (5) other national emergency, or
- (6) to preserve the neutrality of the United States.

**EO--Aeronautical Radionavigation-Satellite Space Station:** A space station in the aeronautical radionavigation-satellite service. (RR)

**FA--Aeronautical Station:** A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea. (RR)

**FG--Aeronautical Station (OR):** An aeronautical station in the aeronautical mobile (OR) service. (RR)

**FD--Aeronautical Station (R):** An aeronautical station in the aeronautical mobile (R) service. (RR)

**FLEA--Aeronautical Telemetry Land Station:** A telemetry land station used in the flight testing of manned or unmanned aircraft, missiles, or major components thereof.

**MOEA--Aeronautical Telemetry Mobile Station:** A telemetry mobile station used for transmitting data directly related to the airborne testing of the vehicle. (or major components), on which the station is installed.

**FLU--Aeronautical Utility Land Station:** A land station located at airdrome control towers and used for control of ground vehicles and aircraft on the ground at airdromes.

**MOU--Aeronautical Utility Mobile Station:** A mobile station used for communication at airdromes with the aeronautical utility land station, the airdrome control station, the FAA flight service station, ground vehicles, and aircraft on the ground. (All transmissions shall be subject to the control of the airdrome control station and shall be discontinued immediately when so requested by the airdrome control operators.)

**TJ--Aircraft Earth Station:** A mobile earth station in the aeronautical mobile-satellite service located on board an aircraft. (RR)

**MA--Aircraft Station:** A mobile station in the aeronautical mobile service, other than a survival craft station, located on board an aircraft. (RR)

**FAC--Airdrome Control Station:** An aeronautical station providing communication between an airdrome control tower and aircraft.

**AMA--Altimeter Station:** A radionavigation mobile station in the aeronautical radionavigation service which employs a radio altimeter.

**TY--Base Earth Station:** An earth station in the fixed-satellite service or in some cases in the land mobile-satellite service located at a specified fixed point or within a specified area on land to provide a feeder link for the land mobile-satellite service. (RR)

**FB--Base Station:** A land station in the land mobile service. (RR)

**EB--Broadcasting-Satellite Space Station (sound broadcasting):** A space station in the broadcasting-satellite service (sound broadcasting). (RR)

**EV--Broadcasting-Satellite Space Station (television):** A space station in the broadcasting-satellite service (television). (RR)

**BC--Broadcasting Station (sound):** A station (sound) in the broadcasting service. (RR)

**BT--Broadcasting Station (television):** A station (television) in the broadcasting service. (RR)

**TI--Coast Earth Station:** An earth station in the fixed-satellite service or in some cases in the maritime mobile-satellite service located at a specified fixed point on land to provide a feeder link for the maritime mobile-satellite service. (RR)

**FC--Coast Station:** A land station in the maritime mobile service. (RR)

**DGP--Differential-Global-Positioning-System (DGPS) Station:** a terrestrial station used for the transmission of differential correction information to DGPS receivers aboard aircraft for navigation.

**TW--Earth Exploration-Satellite Earth Station:** An earth station in the Earth exploration-satellite service. (RR)

**E3--Earth Exploration-Satellite (active sensor) Space Station:** An active sensor on a space station in the Earth exploration-satellite service.

**E4--Earth Exploration-Satellite (passive sensor) Space Station:** A passive sensor on a space station in the Earth exploration-satellite service.

**EW--Earth Exploration-Satellite Space Station:** A space station in the Earth exploration-satellite service. (RR)

**TP--Earth Station (receiving):** An earth station used for receiving. (RR) (TP is not used on applications.)

**XM--Experimental Composite Station:** An experimental station used in experimental operations of a complex nature not readily specified or used in operation which is a composite of two or more of the established experimental categories.

**XC--Experimental Contract Developmental Station:** An experimental station used for the evaluation or testing under federal government contract of electronics equipment or systems in a design or development stage.

**XD--Experimental Developmental Station:** An experimental station used for evaluation or testing of electronics equipment or systems in a design or development stage.

**XE--Experimental Export Station:** An experimental station intended for export and used for the evaluation or testing of electronics equipment or systems in the design or development stage.

**XR**--Experimental Research Station: An experimental station used in basic studies concerning scientific investigations looking toward the improvement of the art of radiocommunications.

**EX**--Experimental Station: A station utilizing radio waves in experiments with a view to the development of science or technique. This definition does not include amateur stations. (RR) (EX is not used on applications.)

**XT**--Experimental Testing Station: An experimental station used for the evaluation or testing of electronics equipment or systems, including site selection and transmission path surveys, which have been developed for operational use.

**TC**--Fixed-Satellite Earth Station: An earth station in the fixed-satellite service. (RR)

**EC**--Fixed-Satellite Space Station: A space station in the fixed-satellite service. (RR)

**FX**--Fixed Station: A station in the fixed service. (RR)

**FLB**--Flight Telemetry Land Station: A telemetry land station the emissions of which are used for telemetry to a balloon; to a booster or rocket, excluding a booster or rocket in orbit about the Earth or in deep space; or to an aircraft, excluding a station used in the flight testing of an aircraft.

**MOB**--Flight Telemetry Mobile Station: A telemetry mobile station used for transmitting data from an airborne vehicle, excluding data related to airborne testing of the vehicle itself, (or major components thereof).

**FAT**--Flight Test Station: An aeronautical station used for the transmission of essential communications in connection with the testing of aircraft or major components of aircraft.

**ALG**--Glide Path (Slope) Station: A radionavigation land station which provides vertical guidance to aircraft during approach to landing.

**FXH**--Hydrologic and Meteorological Fixed Station: A fixed station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**FLH**--Hydrologic and Meteorological Land Station: A land station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**MOH**--Hydrologic and Meteorological Mobile Station: A mobile station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**ES**--Inter-Satellite Space Station: A space station in the inter-satellite service. (RR)

**VA**--Land Earth Station: An earth station in the fixed-satellite service or in some cases in the mobile-satellite service located at a specified point or within a specified area on land to provide a feeder link for the mobile-satellite service. (RR)

**TU**--Land Mobile Earth Station: A mobile earth station in the land mobile-satellite service capable of surface movement within the geographical limits of a country or continent. (RR)

**EU**--Land Mobile-Satellite Space Station: A space station in the land mobile-satellite service. (RR)

**ML**--Land Mobile Station: A mobile station in the land mobile service capable of surface movement within the geographical limits of a country or continent. (RR)

**FL**--Land Station: A station in the mobile service not intended to be used while in motion. (RR)

**ALL**--Localizer Station: A radionavigation land station in the aeronautical radionavigation service which employs an Instrument Landing System Localizer.

**RNL**--Loran Station: A long distance radionavigation land station transmitting synchronized pulses. Hyperbolic lines of position are determined by the measurement of the difference in the time of arrival of these pulses.

**FCB**--Marine Broadcast Station: A coast station which makes scheduled broadcasts of time, meteorological, and hydrographic information.

**NLC**--Maritime Radar Beacon (racon) Station: A land station in the maritime radionavigation service which employs a radar beacon (racon).

**NLM**--Maritime Radiobeacon Station: A radiobeacon station in the maritime radionavigation service intended for the benefit of ships.

**EG**--Maritime Mobile-Satellite Space Station: A space station in the maritime mobile-satellite service. (RR)

**NL**--Maritime Radionavigation Land Station: A land station in the Maritime radionavigation service not intended for use while in motion.

**TX**--Maritime Radionavigation-Satellite Earth Station: A fixed earth station in the maritime radionavigation-satellite service. (RR)

**TQ**--Maritime Radionavigation-Satellite Mobile Earth Station: A mobile earth station in the maritime radionavigation-satellite service. (RR)

**EQ**--Maritime Radionavigation-Satellite Space Station: A space station in the maritime radionavigation-satellite service. (RR)

**SM**--Meteorological Aids Base Station: A land station in the meteorological aids service not intended for use while in motion.

**SA--Meteorological Aids Mobile Station:** A mobile station in the meteorological aids service intended to be used while in motion or during halts at unspecified points.

**SMD--Meteorological Radar Station:** A station in the meteorological aids service employing radar.

**TM--Meteorological-Satellite Earth Station:** An earth station in the meteorological-satellite service. (RR)

**EM--Meteorological-Satellite Space Station:** A space station in the meteorological-satellite service. (RR)

**UA--Mobile Earth Station:** An earth station in the mobile-satellite service intended to be used while in motion or during halts at unspecified points. (RR)

**EI--Mobile-Satellite Space Station:** A space station in the mobile-satellite service. (RR)

**MO--Mobile Station:** A station in the mobile service intended to be used while in motion or during halts at unspecified points. (RR)

**OE--Oceanographic Data Interrogating Station:** A station in the maritime mobile service the emissions of which are used to initiate, modify or terminate functions of equipment directly associated with an oceanographic data station, including the station itself.

**OD--Oceanographic Data Station:** A station in the maritime mobile service located on a ship, buoy, or other sensor platform the emissions of which are used for transmission of oceanographic data.

**ALO--Omnidirectional Range Station:** A radionavigation land station in the aeronautical radionavigation service providing direct indication of the bearing (omnibearing) of that station from an aircraft.

**MAP--Portable Aircraft Station:** A portable station operating in the aeronautical mobile service.

**MLP--Portable Land Mobile Station:** A portable station operating in the land mobile service.

**MRP--Portable Radiolocation Station:** A portable station operating in the radiolocation service.

**MOP--Portable Mobile Station:** A portable station operating in the mobile service.

**MSP--Portable Ship Station:** A portable station operating in the maritime mobile service.

**FP--Port Station:** A coast station in the port operations service. (RR)

**SMB--Radar Beacon Precipitation Gage Station:** A transponder station in the meteorological aids service, the emissions of which are used for telemetering.

**RA--Radio Astronomy Station:** A station in the radio astronomy service. (RR) (This is always a receiving station.)

**MOB--Radio Beacon Mobile Station:** A mobile station the emissions of which are used to determine its location.

**TF--Radiodetermination-Satellite Earth Station:** A fixed earth station in the radiodetermination-satellite service. (RR)

**TL--Radiodetermination-Satellite Mobile Earth Station:** A mobile earth station in the radiodetermination-satellite service. (RR)

**EF--Radiodetermination-Satellite Space Station:** A space station in the radiodetermination-satellite service. (RR)

**RG--Radio Direction-Finding Station:** A radiodetermination station using radio direction-finding. (RR)

**LR--Radiolocation Land Station:** A station in the radiolocation service not intended to be used while in motion. (RR)

**MR--Radiolocation Mobile Station:** A station in the radiolocation service intended to be used while in motion or during halts at unspecified points. (RR)

**RN--Radionavigation Land Station:** A station in the radionavigation service not intended to be used in motion. (RR)

**ALTM--Radionavigation Land Test Station (Maintenance Test Facility):** A radionavigation land station in the aeronautical radionavigation service which is used as a radionavigation calibration station for the transmission of essential information in connection with the testing and calibration of aircraft navigational aids, receiving equipment and interrogators at predetermined surface locations. The primary purpose of this facility is to permit maintenance testing by aircraft radio service personnel.

**ALTO--Radionavigation Land Test Station (Operational Test Facility):** A radionavigation land station in the aeronautical radionavigation service which is used as a radionavigation calibration station for the transmission of essential information in connection with the testing and calibration of aircraft navigational aids, receiving equipment and interrogators at predetermined surface locations. The primary purpose of this facility is to permit the pilot to check a radionavigation system aboard the aircraft prior to takeoff.

**NR--Radionavigation Mobile Station:** A station in the radionavigation service intended to be used while in motion or during halts at unspecified points. (RR)

**TN--Radionavigation-Satellite Fixed Earth Station:** A fixed earth station in the radionavigation-satellite service. (RR)

**UM--Radionavigation-Satellite Mobile Earth Station:** A mobile earth station in the radionavigation-satellite service. (RR)

**EN--Radionavigation-Satellite Space Station:** A space station in the radionavigation-satellite service. (RR)



**ALR**--Radio Range Station: A radionavigation land station in the aeronautical radionavigation service providing radial equisignal zones. (In certain instances a radio range station may be placed on board a ship.)

**SAR**--Radiosonde Station: A station in the meteorological aids service employing a radiosonde.

**SMRG**--Radiosonde Ground Station: A station in the meteorological aids service employing a ground station associated with a radiosonde.

**TE**--Satellite EPIRB Station: A satellite Emergency Position-Indicating Radio Beacon (EPIRB) in the mobile-satellite service. (RR)

**TG**--Ship Earth Station: A mobile earth station in the maritime mobile-satellite service located on board ship. (RR)

**MS**--Ship Station: A mobile station in the maritime mobile service located on board a vessel which is not permanently moored, other than a survival craft station. (RR)

**SN**--Sounder Network Station: A station equipped with an ionosphere sounder used for the real-time selection of frequencies for operational communication circuits.

**SP**--Sounder Prediction Station: A station equipped with an ionosphere sounder for real-time monitoring of upper atmosphere phenomena or to obtain data for the prediction of propagation conditions.

**TT**--Space Operation Earth Station: An earth station in the space operation service. (RR)

**ET**--Space Operation Space Station: A space station in the space operation service. (RR)

**TH**--Space Research Earth Station: An earth station in the space research service. (RR)

**EH**--Space Research Space Station: A space station in the space research service.

**E1**--Space Research (active sensor) Space Station: An active sensor on a space station in the space research service.

**E2**--Space Research (passive sensor) Space Station: A passive sensor on a space station in the space research service.

**ME**--Space Station: A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere. (RR) (ME is not used on applications.)

**TD**--Space Telecommand Earth Station: An earth station the emissions of which are used for space telecommand.

**ED**--Space Telecommand Space Station: A space station which receives emissions used for space telecommand.

**TR**--Space Telemetry Earth Station: An earth station which receives emissions used for space telemetry.

**ER**--Space Telemetry Space Station: A space station the emissions of which are used for space telemetry.

**TK**--Space Tracking Earth Station: An earth station which transmits or receives emissions used for space tracking.

**EK**--Space Tracking Space Station: A space station which transmits or receives and retransmits emissions used for space tracking.

**SS**--Standard Frequency and Time Signal Station: A station in the standard frequency and time signal service. (RR)

**EE**--Standard Frequency Satellite Space Station: A space station in the standard frequency satellite service. (RR)

**FLEC**--Surface Telemetry Land Station: A telemetry land station the emissions of which are intended to be received on the surface of the Earth.

**MOEC**--Surface Telemetry Mobile Station: A telemetry mobile station located on the surface of the Earth and the emissions of which are intended to be received on the surface of the Earth.

**ALS**--Surveillance Radar Station: A radionavigation land station in the aeronautical radionavigation service employing radar to display the presence of aircraft within its range. (In certain instances, a surveillance radar station may be placed on board a ship.)

**FAD**--Telecommand Aeronautical Station: A land station in the aeronautical mobile service the emissions of which are used for terrestrial telecommand.

**MAD**--Telecommand Aircraft Station: A mobile station in the aeronautical mobile service the emissions of which are used for terrestrial telecommand.

**FBD**--Telecommand Base Station: A land station in the land mobile service the emissions of which are used for terrestrial telecommand.

**FCD**--Telecommand Coast Station: A land station in the maritime mobile service the emissions of which are used for terrestrial telecommand.

**FXD**--Telecommand Fixed Station: A fixed station in the fixed service the emissions of which are used for terrestrial telecommand.

**FLD**--Telecommand Land Station: A land station in the mobile service the emissions of which are used for terrestrial telecommand.

**MLD**--Telecommand Land Mobile Station: A mobile station in the land mobile service the emissions of which are used for terrestrial telecommand.

**MOD**--Telecommand Mobile Station: A mobile station in the mobile service the emissions of which are used for terrestrial telecommand.

**MSD**--Telecommand Ship Station: A mobile station in the maritime mobile service the emissions of which are used for terrestrial telecommand.

**FXE**--Telemetry Fixed Station: A fixed station the emissions of which are used for telemetry.  
**FLE**--Telemetry Land Station: A land station the emissions of which are used for telemetry.  
**MOE**--Telemetry Mobile Station: A mobile station the emissions of which are used for telemetry.

### 6.1.3 Stations (alphabetical by symbols)

1. Where a definition is followed by the parenthetical expression "(RR)," it is an indication that the definition is in the ITU Radio Regulations.

2. The suffix "R" shall be added to the established class of station (STC) symbol only if the station is to be used primarily as a repeater in the bands:

29.89-50.00 MHz (exclusive federal government bands).

138.00-144.00 MHz

148.00-149.90 MHz

150.05-150.80 MHz

162.00-174.00 MHz

380-399.9 MHz (G27)

406.10-420.00 MHz

For this purpose, a repeater consists of a radio transmitter, a radio receiver, and coupling between the two so as to retransmit, unchanged in intelligence, the received signal.

3. The following definitions of stations and associated Station Class (STC) (see Section 9.8.2, paragraph 15a through 15c) symbols are used on federal frequency assignments as applicable.

**AL**--Aeronautical Radionavigation Land Station: A land station in the aeronautical radionavigation service not intended for use while in motion.

**ALA**--Aeronautical Marker Beacon Station: A radionavigation land station in the aeronautical radionavigation service which employs a marker beacon.

**ALB**--Aeronautical Radiobeacon Station: A radiobeacon station in the aeronautical radionavigation service intended for the benefit of aircraft.

**ALC**--Aeronautical Radar Beacon (racon) Station: A land station in the aeronautical radionavigation service which employs a radar beacon (racon).

**ALG**--Glide Path (Slope) Station: A radionavigation land station which provides vertical guidance to aircraft during approach to landing.

**ALL**--Localizer Station: A radionavigation land station in the aeronautical radionavigation service which employs an Instrument Landing System Localizer.

**ALO**--Omnidirectional Range Station: A radionavigation land station in the aeronautical radionavigation service providing direct indication of the bearing (omnibearing) of that station from an aircraft.

**ALR**--Radio Range Station: A radionavigation land station in the aeronautical radionavigation service providing radial equisignal zones. (In certain instances a radio range station may be placed on board a ship.)

**ALS**--Surveillance Radar Station: A radionavigation land station in the aeronautical radionavigation service employing radar to display the presence of aircraft within its range. (In certain instances, a surveillance radar station may be placed on board a ship.)

**ALTM**--Radionavigation Land Test Station (Maintenance Test Facility): A radionavigation land station in the aeronautical radionavigation service which is used as a radionavigation calibration station for the transmission of essential information in connection with the testing and calibration of aircraft navigational aids, receiving equipment and interrogators at predetermined surface locations. The primary purpose of this facility is to permit maintenance testing by aircraft radio service personnel.

**ALTO**--Radionavigation Land Test Station (Operational Test Facility): A radionavigation land station in the aeronautical radionavigation service which is used as a radionavigation calibration station for the transmission of essential information in connection with the testing and calibration of aircraft navigational aids, receiving equipment and interrogators at predetermined surface locations. The primary purpose of this facility is to permit the pilot to check a radionavigation system aboard the aircraft prior to takeoff.

**AM**--Aeronautical Radionavigation Mobile Station: A mobile station in the aeronautical radionavigation service intended to be used while in motion or during halts at unspecified points.

**AMA**--Altimeter Station: A radionavigation mobile station in the aeronautical radionavigation service which employs a radio altimeter.

**BC**--Broadcasting Station (sound): A station (sound) in the broadcasting service. (RR)

**BT**--Broadcasting Station (television): A station (television) in the broadcasting service. (RR)

**EB--Broadcasting-Satellite Space Station (sound broadcasting):** A space station in the broadcasting-satellite service (sound broadcasting). (RR)

**DGP--Differential-Global-Positioning-System (DGPS) Station:** a terrestrial station used for the transmission of differential correction information to DGPS receivers aboard aircraft for navigation.

**EC--Fixed-Satellite Space Station:** A space station in the fixed-satellite service. (RR)

**ED--Space Telecommand Space Station:** A space station which receives emissions used for space telecommand. (RR)

**EE--Standard Frequency Satellite Space Station:** A space station in the standard frequency satellite service. (RR)

**EF--Radiodetermination-Satellite Space Station:** A space station in the radiodetermination-satellite service. (RR)

**EG--Maritime Mobile-Satellite Space Station:** A space station in the maritime mobile-satellite service. (RR)

**EH--Space Research Space Station:** A space station in the space research service. (RR)

**EI--Mobile-Satellite Space Station:** A space station in the mobile-satellite service. (RR)

**EJ--Aeronautical Mobile-Satellite Space Station:** A space station in the aeronautical mobile-satellite service. (RR)

**EK--Space Tracking Space Station:** A space station which transmits or receives and retransmits emissions used for space tracking.

**EM--Meteorological-Satellite Space Station:** A space station in the meteorological-satellite service. (RR)

**EN--Radionavigation-Satellite Space Station:** A space station in the radionavigation-satellite service. (RR)

**EO--Aeronautical Radionavigation-Satellite Space Station:** A space station in the aeronautical radionavigation-satellite service. (RR)

**EQ--Maritime Radionavigation-Satellite Space Station:** A space station in the maritime radionavigation-satellite service. (RR)

**ER--Space Telemetry Space Station:** A space station the emissions of which are used for space telemetry.

**ES--Inter-Satellite Space Station:** A space station in the inter-satellite service. (RR)

**ET--Space Operation Space Station:** A space station in the space operation service. (RR)

**EU--Land Mobile-Satellite Space Station:** A space station in the land mobile-satellite service. (RR)

**EV--Broadcasting-Satellite Space Station (television):** A space station in the broadcasting-satellite service (television). (RR)

**EW--Earth Exploration-Satellite Space Station:** A space station in the Earth exploration-satellite service. (RR)

**EX--Experimental Station:** A station utilizing radio waves in experiments with a view to development of science or technique. (RR) (EX is not used on applications.)

**E1--Space Research (active sensor) Space Station:** An active sensor on a space station in the space research service.

**E2--Space Research (passive sensor) Space Station:** A passive sensor on a space station in the space research service.

**E3--Earth Exploration-Satellite (active sensor) Space Station:** An active sensor on a space station in the Earth exploration-satellite service.

**E4--Earth Exploration-Satellite (passive sensor) Space Station:** A passive sensor on a space station in the Earth exploration-satellite service.

**FA--Aeronautical Station:** A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example on board ship or on a platform at sea. (RR)

**FAB--Aeronautical Broadcast Station:** An aeronautical station which makes scheduled broadcasts of meteorological information and notices to airmen. (In certain instances, an aeronautical broadcast station may be placed on board a ship.)

**FAC--Airdrome Control Station:** An aeronautical station providing communication between an airdrome control tower and aircraft.

**FAD--Telecommand Aeronautical Station:** A land station in the aeronautical mobile service the emissions of which are used for terrestrial telecommand.

**FAT--Flight Test Station:** An aeronautical station used for the transmission of essential communications in connection with the testing of aircraft or major components of aircraft.

**FB--Base Station:** A land station in the land mobile service. (RR)

**FBD--Telecommand Base Station:** A land station in the land mobile service the emissions of which are used for terrestrial telecommand.

**FC--Coast Station:** A land station in the maritime mobile service. (RR)

**FCB--Marine Broadcast Station:** A coast station which makes scheduled broadcast of time, meteorological, and hydrographic information.

**FCD--Telecommand Coast Station:** A land station in the maritime mobile service the emissions of which are used for terrestrial telecommand.

**FD--Aeronautical Station (R):** An aeronautical station in the aeronautical mobile (R) service. (RR)

**FG--Aeronautical Station (OR):** An aeronautical station in the aeronautical mobile (OR) service. (RR)

**FL--Land Station:** A station in the mobile service not intended to be used while in motion. (RR)

**FLD--Telecommand Land Station:** A land station in the mobile service the emissions of which are used for terrestrial telecommand.

**FLE--Telemetry Land Station:** A land station the emissions of which are used for telemetry.

**FLEA--Aeronautical Telemetry Land Station:** A telemetry land station used in the flight testing of manned or unmanned aircraft, missiles, or major components thereof.

**FLEB--Flight Telemetry Land Station:** A telemetry land station the emissions of which are used for telemetry to a balloon; to a booster or rocket, excluding a booster or rocket in orbit about the Earth or in deep space; or to an aircraft, excluding a station used in the flight testing of an aircraft.

**FLEC--Surface Telemetry Land Station:** A telemetry land station the emissions of which are intended to be received on the surface of the Earth.

**FLH--Hydrologic and Meteorological Land Station:** A land station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**FLU--Aeronautical Utility Land Station:** A land station located at airdrome control towers and used for control of ground vehicles and aircraft on the ground at airdromes.

**FP--Port Station:** A coast station in the port operations service. (RR)

**FX--Fixed Station:** A station in the fixed service. (RR)

**FXD--Telecommand Fixed Station:** A fixed station in the fixed service the emissions of which are used for terrestrial telecommand.

**FXE--Telemetry Fixed Station:** A fixed station the emissions of which are used for telemetry.

**FXH--Hydrologic and Meteorological Fixed Station:** A fixed station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**LR--Radiolocation Land Station:** A station in the radiolocation service not intended to be used while in motion. (RR)

**MA--Aircraft Station:** A mobile station in the aeronautical mobile service other than a survival craft station, located on board an aircraft. (RR)

**MAD--Telecommand Aircraft Station:** A mobile station in the aeronautical mobile service the emissions of which are used for terrestrial telecommand.

**MAP--Portable Aircraft Station:** A portable station operating in the aeronautical mobile service.

**ME--Space Station:** A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere. (RR) (ME is not used on applications.)

**ML--Land Mobile Station:** A mobile station in the land mobile service capable of surface movement within the geographical limits of a country or continent. (RR)

**MLD--Telecommand Land Mobile Station:** A mobile station in the land mobile service the emissions of which are used for terrestrial telecommand.

**MLP--Portable Land Mobile Station:** A portable station operating in the land mobile service.

**MO--Mobile Station:** A station in the mobile service intended to be used while in motion or during halts at unspecified points. (RR)

**MOB--Radio Beacon Mobile Station:** A mobile station the emissions of which are used to determine its location.

**MOD--Telecommand Mobile Station:** A mobile station in the mobile service the emissions of which are used for terrestrial telecommand.

**MOE--Telemetry Mobile Station:** A mobile station the emissions of which are used for telemetry.

**MOEA--Aeronautical Telemetry Mobile Station:** A telemetry mobile station used for transmitting data directly related to the airborne testing of the vehicle, (or major components), on which the station is installed.

**MOEC--Surface Telemetry Mobile Station:** A telemetry mobile station located on the surface of the Earth and the emissions of which are intended to be received on the surface of the Earth.

**MOEB--Flight Telemetry Mobile Station:** A telemetry mobile station used for transmitting data from an airborne vehicle, excluding data related to airborne testing of the vehicle itself, (or major components thereof).

**MOH--Hydrologic and Meteorological Mobile Station:** A mobile station the emissions of which are used for the automatic transmission of either hydrologic or meteorological data, or both.

**MOP--Portable Mobile Station:** A portable station operating in the mobile service.

**MOU--Aeronautical Utility Mobile Station:** A mobile station used for communication at airdromes with the aeronautical utility land station, the airdrome control station, the FAA flight service station, ground vehicles, and aircraft on the ground. (All transmissions shall be subject to the control of the airdrome control station and shall be discontinued immediately when so requested by the airdrome control operators.)

**MR**--Radiolocation Mobile Station: A station in the radiolocation service intended to be used while in motion or during halts at unspecified points. (RR)

**MRP**--Portable Radiolocation Station: A portable station operating in the radiolocation service.

**MS**--Ship Station: A mobile station in the maritime mobile service located on board a vessel which is not permanently moored, other than a survival craft station. (RR)

**MSD**--Telecommand Ship Station: A mobile station in the maritime mobile service the emissions of which are used for terrestrial telecommand.

**MSP**--Portable Ship Station: A portable station operating in the maritime mobile service.

**NL**--Maritime Radionavigation Land Station: A land station in the Maritime Radionavigation Service not intended for use while in motion.

**NLC**--Maritime Radar Beacon (racon) Station: A land station in the maritime radionavigation service which employs a radar beacon (racon).

**NLM**--Marine Radiobeacon Station: A radiobeacon station in the maritime radionavigation service intended for the benefit of ships.

**NR**--Radionavigation Mobile Station: A station in the radionavigation service intended to be used while in motion or during halts at unspecified points. (RR)

**OD**--Oceanographic Data Station: A station in the maritime mobile service located on a ship, buoy or other sensor platform the emissions of which are used for the transmission of oceanographic data.

**OE**--Oceanographic Data Interrogating Station: A station in the maritime mobile service the emissions of which are used to initiate, modify, or terminate functions of equipment directly associated with an oceanographic data station, including the station itself.

**RA**--Radio Astronomy Station: A station in the radio astronomy service. (RR) (This is always a receiving station.)

**RG**--Radio Direction-Finding Station: A radiodetermination station using radio direction-finding. (RR)

**RN**--Radionavigation Land Station: A station in the radionavigation service not intended to be used in motion. (RR)

**RNL**--Loran Station: A long distance radionavigation land station transmitting synchronized pulses. Hyperbolic lines of position are determined by the measurement of the difference in the time of arrival of these pulses.

**SA**--Meteorological Aids Mobile Station: A mobile station in the meteorological aids service intended to be used while in motion or during halts at unspecified points.

**SAR**--Radiosonde Station: A station in the meteorological aids service employing a radiosonde.

**SM**--Meteorological Aids Base Station: A land station in the meteorological aids service not intended for use while in motion.

**SMB**--Radar Beacon Precipitation Gage Station: A transponder station in the meteorological aids service, the emissions of which are used for telemetering.

**SMD**--Meteorological Radar Station: A station in the meteorological aids service employing radar.

**SMRG**--Radiosonde Ground Station: A station in the meteorological aids service employing a ground station associated with a radiosonde.

**SN**--Sonder Network Station: A station equipped with an ionosphere sounder used for the real-time selection of frequencies for operational communication circuits.

**SP**--Sonder Prediction Station: A station equipped with an ionosphere sounder for real-time monitoring of upper atmosphere phenomena or to obtain data for the prediction of propagation conditions.

**SS**--Standard Frequency and Time Signal Station: A station in the standard frequency and time signal service. (RR)

**TB**--Aeronautical Earth Station: An earth station in the fixed-satellite service or in some cases in the aeronautical mobile-satellite service located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service. (RR)

**TC**--Fixed-Satellite Earth Station: An earth station in the fixed-satellite service. (RR)

**TD**--Space Telecommand Earth Station: An earth station the emissions of which are used for space telecommand.

**TE**--Satellite EPIRB Station: A satellite Emergency Position-Indicating Radio Beacon (EPIRB) in the mobile-satellite service (RR).

**TF**--Radiodetermination-Satellite Earth Station: A fixed earth station in the radiodetermination-satellite service. (RR)

**TG**--Ship Earth Station: A mobile earth station in the maritime mobile-satellite service located on board ship. (RR)

**TH**--Space Research Earth Station: An earth station in the space research service. (RR)

**TI**--Coast Earth Station: An earth station in the fixed-satellite service or in some cases in the maritime mobile-satellite service located at a specified fixed point on land to provide a feeder link for the maritime mobile-satellite. (RR)

**TJ**--Aircraft Earth Station: A mobile earth station in the aeronautical mobile-satellite service located on board an aircraft. (RR)

**TK**--Space Tracking Earth Station: An earth station which transmits or receives emissions used for space tracking.

**TL**--Radiodetermination-Satellite Mobile Earth Station: A mobile earth station in the radiodetermination-satellite service. (RR)

**TM**--Meteorological-Satellite Earth Station: An earth station in the meteorological-satellite service. (RR)

**TN**--Radionavigation-Satellite Fixed Earth Station: A fixed earth station in the radionavigation-satellite service. (RR)

**TO**--Aeronautical Radionavigation-Satellite Mobile Earth Station: A mobile earth station in the aeronautical radionavigation-satellite service. (RR)

**TP**--Earth Station (receiving): An earth station used for receiving. (RR) (TP is not used on applications.)

**TQ**--Maritime Radionavigation-Satellite Mobile Earth Station: A mobile earth station in the maritime radionavigation-satellite service. (RR)

**TR**--Space Telemetry Earth Station: An earth station which receives emissions used for space telemetry.

**TT**--Space Operation Earth Station: An earth station in the space operation service. (RR)

**TU**--Land Mobile Earth Station: A mobile earth station in the land mobile-satellite service capable of surface movement within the geographical limits of a country or continent. (RR)

**TW**--Earth Exploration-Satellite Earth Station: An earth station in the Earth exploration-satellite service. (RR)

**TX**--Maritime Radionavigation-Satellite Earth Station: A fixed earth station in the maritime radionavigation-satellite service. (RR)

**TY**--Base Earth Station: An earth station in the fixed-satellite service or in some cases in the land mobile-satellite service located at a specified fixed point or within a specified area on land to provide a feeder link for the land mobile-satellite service. (RR)

**TZ**--Aeronautical Radionavigation-Satellite Earth Station: A fixed earth station in the aeronautical radionavigation-satellite service. (RR)

**UA**--Mobile Earth Station: An earth station in the mobile-satellite service intended to be used while in motion or during halts at unspecified points. (RR)

**UM**--Radionavigation-Satellite Mobile Earth Station: A mobile earth station in the radionavigation-satellite service. (RR)

**VA**--Land Earth Station: An earth station in the fixed-satellite service or, in some cases, in the mobile-satellite service, located at a specified fixed point or within a specified area on land to provide a feeder link for the mobile-satellite service. (RR)

**XC**--Experimental Contract Developmental Station: An experimental station used for the evaluation or testing under federal government contract of electronics equipment or systems in a design or development stage.

**XD**--Experimental Developmental Station: An experimental station used for evaluation or testing of electronics equipment or systems in a design or development stage.

**XE**--Experimental Export Station: An experimental station intended for export and used for the evaluation or testing of electronics equipment or systems in the design or development stage.

**XM**--Experimental Composite Station: An experimental station used in experimental operations of a complex nature not readily specified or used in an operation which is a composite of two or more of the established experimental categories.

**XR**--Experimental Research Station: An experimental station used in basic studies concerning scientific investigation looking toward the improvement of the art of radiocommunications.

**XT**--Experimental Testing Station: An experimental station used for the evaluation or testing of electronics equipment or systems, including site selection and transmission path surveys, which have been developed for operational use.

#### 6.1.4 Table of Services, Station Classes, and Stations

Table A is used to determine the proper Station Class (STC) symbol (see Section 9.8.2, paragraph 15a through 15c) to be used versus the Service in which the transmitting station will operate. Frequency bands are allocated to Service(s) based upon the National Table of Frequency Allocations (see Section 4.1.3).

TABLE A. Table of Services, Station Classes, and Stations		
Service	Station Class	Station
1. Amateur	None	Amateur
2. Broadcasting	BC BT	Broadcasting (sound) Broadcasting (television)
3. Broadcasting-Satellite	EB EV	Space (sound) Space (television)
4. Earth Exploration-Satellite	EW E3 E4 TW	Space Space (active sensor) Space (passive sensor) Earth
<i>Meteorological-Satellite</i>	EM TM	Space Earth
5. Fixed	FX FXD FXE FXH	Fixed Telecommand Fixed Telemetry Fixed Hydrologic and Meteorological Fixed
6. Fixed-Satellite	EC TC VA TB TI TY	Space Earth Land Earth Earth Coast Earth Base Earth
7. Inter-Satellite	ES	Space
8. Meteorological Aids	SA SAR SM SMB SMD SMRG	Meteorological Aids Mobile Station Radiosonde Meteorological Aids Base Station Radar Beacon Precipitation Gauge Meteorological Radar Radiosonde Ground
9. Mobile	FL FLD FLE FLEA FLEB FLEC FLH FLU MO MOB MOD MOE MOEA MOEB MOEC MOH MOP MOU	Land Telecommand Land Telemetry Land Aeronautical Telemetry Land Flight Telemetry Land Surface Telemetry Land Hydrologic and Meteorological Land Aeronautical Utility Land Mobile Radio Beacon Mobile Telecommand Mobile Telemetry Mobile Aeronautical Telemetry Mobile Flight Telemetry Mobile Surface Telemetry Mobile Hydrologic and Meteorological Mobile Portable Mobile Aeronautical Utility Mobile
<i>Aeronautical Mobile</i>	FA FAB FAC FAD FAT MA MAD MAP	Aeronautical Aeronautical Broadcast Airdrome Control Telecommand Aeronautical Flight Test Aircraft Telecommand Aircraft Portable Aircraft
<i>Aeronautical Mobile (OR)</i>	FG	Aeronautical
<i>Aeronautical Mobile (R)</i>	FD	Aeronautical
<i>Land Mobile</i>	FB	Base

TABLE A. Table of Services, Station Classes, and Stations		
Service	Station Class	Station
	FBD ML MLD MLP	Telecommand Base Land Mobile Telecommand Land Mobile Portable Land Mobile
<i>Maritime Mobile</i>	FC FCB FCD MS MSD MSP OD OE	Coast Marine Broadcast Telecommand Coast Ship/Telecommand Ship Telecommand Ship Portable Ship Oceanographic Data Oceanographic Data Interrogating
10. Mobile-Satellite	UA TE EI VA	Mobile Earth Satellite EPIRB Space Land Earth
<i>Aeronautical Mobile-Satellite</i>	EJ TB TJ	Space Earth Aircraft Earth
<i>Land Mobile-Satellite</i>	EU TU TY	Space Land Mobile Earth Base Earth
<i>Maritime Mobile-Satellite</i>	EG TG TI	Space Ship Earth Coast Earth
11. Radio Astronomy	RA	Radio Astronomy
12. Radiodetermination	None RG	Radiodetermination Radio Direction-Finding
<i>Radiolocation</i>	LR MR MRP	Land Mobile Portable
<i>Radionavigation</i>	NR RNL RN	Mobile LORAN Land
<i>Aeronautical Radionavigation</i>	AL ALA ALB ALC ALG ALL ALO ALR ALS ALTM ALTO AM AMA	Land Marker Beacon Radio Beacon Radar Beacon (Racon) Glide Path (Slope) Localizer Omnidirectional Range Radio Range Surveillance Radar Land Test (Maintenance) Land Test (Operational) Mobile Altimeter
<i>Maritime Radionavigation</i>	NL NLC NLM	Land Radar Beacon (Racon) Marine Radio Beacon
13. Radiodetermination-Satellite	EF TF TL	Space Earth Mobile Earth
<i>Radionavigation-Satellite</i>	EN TN UM	Space Fixed Earth Mobile Earth
<i>Aeronautical Radionavigation-Satellite</i>	EO TO	Space Mobile Earth



TABLE A. Table of Services, Station Classes, and Stations		
Service	Station Class	Station
	TZ	Earth
<i>Maritime Radionavigation-Satellite</i>	EQ	Space
	TQ	Mobile Earth
	TX	Earth
14. Space Operation	ET	Space
	TT	Earth
15. Space Research	EH	Space
	E1	Space (active sensor)
	E2	Space (passive sensor)
	TH	Earth
16. Standard Frequency and Time Signal	SS	Standard Frequency and Time Signal
17. Standard Frequency and Time Signal-Satellite	EE	Space
18. No Specific Service	DGP	Differential-Global-Positioning-System
	ED	Space Telecommand Space
	EK	Space Tracking Space
	ER	Space Telemetry Space
	SN	Sounder Network
	SP	Sounder Prediction
	TD	Space Telecommand Earth
	TK	Space Tracking Earth
	TR	Space Telemetry Earth
	XC	Experimental Contract Developmental
	XD	Experimental Developmental
	XE	Experimental Export
	XM	Experimental Composite
	XR	Experimental Research
	XT	Experimental Testing

## 6.2 FREQUENCY NOMENCLATURE

1. The terms "allocation," "allotment," and "assignment" are used to describe the distribution of frequencies or bands of frequencies. Allocations are made to radio services, for example, the fixed service, the aeronautical mobile service, and the space research service. Allotments are made to areas or countries and, within the Federal Government, to specific uses. Assignments are instruments of authorization of discrete frequencies to specific radio stations.

2. In the application of the provisions of this Manual, letters or numbers shall not be used to designate specific bands of frequencies (e.g., S-band, X-band, and Ku-band. Such designations create confusion), because the band limits vary from one designator system or user group to another. This can be avoided by using the international system of citing in Hertz the actual numerical limits of specific frequency bands. Further, broader portions of the spectrum can be described by the following internationally adopted terms:

### Frequency Subdivision

VLF (very low)  
 LF (low)  
 MF (medium)  
 HF (high)  
 VHF (very high)  
 UHF (ultra high)  
 SHF (super high)  
 EHF (extremely high)  
 300 GHz to 3000 GHz

### Frequency Range

3 kHz to 30 kHz  
 30 kHz to 300 kHz  
 300 kHz to 3000 kHz  
 3 MHz to 30 MHz  
 30 MHz to 300 MHz  
 300 MHz to 3000 MHz  
 3 GHz to 30 GHz  
 30 GHz to 300 GHz

Hz = hertz = cycles per second

K = kilo (10<sup>3</sup>)

M = Mega (10<sup>6</sup>)

G = giga (10<sup>9</sup>)

T = tera (10<sup>12</sup>)

## **6.3 EMISSION DESIGNATORS**

Emissions are designated according to their classification and their necessary bandwidth.

### **6.3.1 Classification of Emissions**

Emissions are classified according to the type of modulation of the main carrier, the nature of signal(s) modulating the main carrier, and the type of information to be transmitted (see Section 9.8.2, paragraph 16). For a more complete description of an emission, two optional characteristics can be added; these are the details of signal(s) and the nature of multiplexing.

### **6.3.2 Necessary Bandwidth**

1. Whenever the full designation of an emission is necessary, the symbol for that emission shall be preceded by a number indicating the necessary bandwidth of the emission.

2. See Annex J for methods used to determine necessary bandwidth and the relationship between occupied and necessary bandwidth. The value so determined shall be used when the full designation of an emission is required. However, the necessary bandwidth so determined is not the only characteristic of an emission to be considered in evaluating the interference that may be caused by that emission.

## **6.4 CLASSES OF EXPERIMENTAL STATIONS**

1. Experiments, experimental operations and experimental activities are used herein to refer to the utilization of radio waves in experiments with a view to the development of the science or technique of radio communication.

2. The classes of experimental stations included in Section 6.1.3 were adopted to allow more precise classification of experimental operations and to provide the means of identifying stations used in support of experimental activities. Two classes normally used by non-federal services (XC and XE) are included for completeness. The broad class EX has been included for its parent definition, but it is not used in making frequency assignments. However, an experimental composite station (XM) has been included. It is the appropriate class for the composite or not-elsewhere-classified type of operation and is used only in those instances where the other classes are not applicable. When it is used, an explanation of the experimental operation must be included on the frequency application under Supplementary Details.

3. An experimental developmental station (XD) may be used for radiation measurements of a transmitter which is a prototype not yet in production or to determine radiation patterns of new antenna design.

4. While the classes included in section 6.1.3 provide a rather precise description of experimental stations, appropriate S-notes and informative remarks can be shown on frequency applications to further describe the intent or special nature of the proposed experimental operation.

5. Experimental classes of stations shall be on a secondary basis to stations of all other services and shall be authorized only by a temporary assignment; however, a space project assignment may be used to authorize a) an experimental station to be operated in the manner of a station in the space service, and b) an experimental station to be used for the static test (prelaunch ground-to-ground checkout) of space communication equipment.

## **6.5 CALL SIGNS**

### **6.5.1 International Provisions**

The international provisions concerning the identification of transmissions of radio stations are contained in Article 19 of the ITU Radio Regulations, 2001.

## 6.5.2 Use of Call Signs

While federal agencies, users of radio, are required to comply with the aforementioned ITU Radio Regulations, the following procedure is the recommended practice, where applicable, in the conduct of operations in the types of services indicated:

### Fixed and Land

1. Each station shall transmit its assigned call sign on each frequency in use at the beginning and end of operation, and at least once an hour. More frequent identification may be made if delay to traffic will not result.
2. Radiotelephony transmissions shall be identified by speaking the words "THIS IS" followed by the letters or alpha-numeric combination of the call sign; or by means of an automatic identifier transmitting in International Morse Code in the prosign, "DE" followed by the call sign. When an automatic identifier is used, it will be programmed to identify the station once every 30 minutes.
3. Radiotelegraphy transmissions shall be identified by sending in international morse code the prosign "DE" followed by the call sign.
4. Radioteletype transmissions shall be identified by transmitting the prosign "DE" followed by the call sign, in teletype characters.
5. Facsimile transmissions shall be identified by any one of the preceding methods after removing the facsimile signal. Pictures need not be interrupted to comply with the hourly identification.
6. Twin-channel single sideband circuits employing telephony on one or both channels shall be identified through the use of radiotelephony identification procedures on either channel.
7. Circuits employing single or multiple tone modulation shall be identified through the use of tone modulated telegraphy on at least one channel employing the procedure described under radiotelegraphy transmissions.

### Mobile

1. A mobile station associated with a base station which transmits only on the transmitting frequency of the associated base station is not required to transmit any identification.
2. A mobile station which transmits on any frequency other than the transmitting frequency of the associated base station, or which has no associated base station, shall transmit the required identification at the end of each transmission or exchange of transmission or once each hour of the operating period.
3. Identification procedures shall be those set forth for the fixed service. A mobile station in the maritime mobile service is subject to the applicable provisions of the ITU Radio Regulations and all other international agreements in force to which the United States is a party.

### Automatic Morse Equipment

Automatically activated equipment may be used to identify radiotelephone stations by the International Morse Code providing the following conditions are met:

- a. The signal output of the automatic identification equipment shall be connected to the transmitter at the microphone input or any other manufacturer provided signal input terminal and shall be adjusted to produce 40% + 10% of the maximum permissible modulation/deviation level. This adjustment shall be performed when all other modulating signals are absent.
- b. The Morse Code transmission rate shall be maintained between 20 and 25 words per minute.
- c. The frequency of the keyed tone comprising the identification signal shall be 1200 Hz + 800 Hz.

### Miscellaneous

1. Stations which are entirely automatic in their operation, such as telemetering, hydrological and weather reporting, and aeronautical instrumentation, are exempt from these requirements.
2. Stations employing complex systems which require special terminal equipment for normal reception of traffic will, so far as practicable, identify at least hourly.

### 6.5.3 Obtaining Call Signs

1. Section 305(b) of the Communications Act of 1934, as amended, provides that, "All stations owned and operated by the United States, except mobile stations of the Army of the United States, and all other stations on land and sea, shall have special call letters designated by the Commission."

2. Federal Agencies requiring call signs must reach out to their agency Spectrum Management Office representative to start the process. This representative will contact NTIA's Interdepartment Radio Advisory Committee (IRAC) Secretariat who will in-turn coordinate with the Federal Communications Commission's International Bureau to obtain the call sign. The IRAC Secretariat can be reached at 202-482-0599 or [IRACSEC@ntia.gov](mailto:IRACSEC@ntia.gov).

## 6.6 MARITIME MOBILE SERVICE IDENTITIES

1. Under the ITU Radio Regulations (RR 19.30), ship stations and ship earth stations to which the provisions of Chapter IX apply, and coast stations or coast earth stations, or other non-shipborne stations capable of communicating with such ship stations, shall have assigned to them maritime mobile service identities, as the need arises. Maritime Mobile Service Identities (MMSI) are formed of a series of nine digits as described in Annexes 1 to 5 of Recommendation ITU-R M.585-8. The maritime identification digits (MID) are an integral part of the maritime mobile service identity and denote the administration responsible for the station so identified. Administrations shall follow Annexes 1 to 5 of Recommendation ITU-R M.585-8 concerning the assignment and use of MMSIs. In the United States the Federal Communications Commission is the responsible agency for the assignment of MMSIs. MMSIs are used as unique addresses for maritime automatic identification systems (AIS) and digital selective calling and, in some cases, maritime mobile satellite services such as INMARSAT.

2. Agencies using maritime mobile service identities shall maintain an up-to-date registration of identities used and periodically provide that information electronically to the IRAC Secretariat who will in turn pass it to the C4ITSC office, U.S. Coast Guard Operations Systems Center, 408 Coast Guard Drive, Kearneysville, WV 25430.

### 6.6.1 Obtaining a Maritime Mobile Service Identity

1. Federal Agencies requiring MMSIs must reach out to their agency Spectrum Management Office representative to start the process. This Representative will contact NTIA's Interdepartment Radio Advisory Committee (IRAC) Secretariat who will provide the MMSI. The IRAC Secretariat can be reached at 202-482-0599 or [IRACSEC@ntia.gov](mailto:IRACSEC@ntia.gov).

2. Information required to obtain an MMSI include the following:

Ship Name	Call Sign	Tonnage	Type
Length	Crew	Emergency POC	Emergency POC Phone
Address	Phone	Fax (If Available)	Email

3. If a ship terminal is transferred, replaced, or deactivated, the agency representative must inform the NTIA IRAC Secretariat.

**(Last Page in Chapter 6)**

## **Chapter 7**

### **Authorized Frequency Usage**

#### **7.1 GENERAL**

1. Within the jurisdiction of the United States, use of the radio frequency spectrum for telecommunication and for other purposes shall be made by United States Government stations and radio frequency devices only as authorized by the Assistant Secretary of Commerce for Communications and Information (Assistant Secretary) or the National Telecommunications and Information Administration (NTIA).

2. The frequency assignments mentioned in Section 7.2 result from the submission of applications by federal agencies (see Chapter 9 of this Manual). The other parts of this chapter contain authority for the use of certain frequencies, services, and radio frequency devices under specified conditions, criteria, standards, or specifications, and the submission of applications therefore is not required. The use of any such assignments, frequencies, or devices may also be subject to applicable policy, guidance, or regulations issued by their users' agency.

##### **7.1.1 Lasers and Other Systems That Operate Above 3000 GHz**

1. No authorization is required for the use of frequencies above 3000 GHz. As a matter of information, agencies may inform the IRAC of such usage, but no record of it shall be kept in the Government Master File (GMF), the list of Frequency Assignments to Government Radio Stations.

2. Under the Communications Act of 1934, as amended, NTIA has the authority to license stations that operate above 3000 GHz, including lasers, but at this time does not choose to do so

#### **7.2 USE OF FREQUENCIES CONTAINED IN THE LIST OF FREQUENCY ASSIGNMENTS TO FEDERAL GOVERNMENT RADIO STATIONS**

1. The frequency assignments contained in the Government Master File (GMF) may be used by federal agencies in accordance with the particulars of those assignments.

2. The complete listing of Federal Government frequency assignments, the GMF is also an important tool for spectrum management activities. Accordingly, data requirements for the particulars of frequency assignments in the GMF may be revised, updated, and expanded as needed to meet changing spectrum management requirements.

#### **7.3 (RESERVED. See Chapter 12.)**

#### **7.4 USE OF FREQUENCIES BY FIXED AND LAND STATIONS**

When it is indispensable to do so, and on the condition that the characteristics of the stations continue to conform to those in the GMF, a fixed station may, on a secondary basis, transmit on its assigned frequencies to mobile stations, and a land station may, on a secondary basis, transmit on its assigned frequencies to fixed stations or other land stations in the same category

#### **7.5 USE OF FREQUENCIES BY MOBILE STATIONS**

##### **7.5.1 Frequencies Assigned to Federal Stations in the Mobile Service and Mobile Earth Stations**

A mobile station may transmit on a frequency assigned to a federal station in the mobile service a) when directed to do so by the latter for the specific purpose of communicating with the station issuing the directive or with other stations in the same net or b) by directive from the agency operating the stations to which the frequency is assigned.

## **7.5.2 Frequencies Authorized by the FCC for Ship Stations**

Frequencies authorized by the Federal Communications Commission for ship stations may be used by federal mobile stations to communicate with non-federal stations in the maritime mobile service.

## **7.5.3 (Reserved. See Chapter 12.)**

## **7.5.4 (Reserved. See Chapter 12.)**

## **7.5.5 Coast Station Frequencies**

A mobile station may transmit on the same frequency as the coast station with which it is communicating, provided that a) the emission satisfies the frequency tolerance applicable to the coast station, b) the coast station requests the transmission, and c) no harmful interference is caused to other stations.

## **7.5.6 (Reserved)**

## **7.5.7 Ship Station Frequencies in the Bands 4000-4063 and 8100-8195 kHz**

Ship stations may transmit (emission: 2K80J3E), with power not exceeding 1.5 kW Peak Envelop Power (PEP), on frequencies designated for radiotelephony in the channeling plans of Section 4.3.13 for inter-ship and ship-shore radiotelephony communications, provided no harmful interference is caused to other authorized users.

## **7.5.8 (Reserved. See Sec. 7.23.)**

## **7.5.9 (Reserved. See Sec. 7.23.)**

## **7.6 USE OF FREQUENCIES BY AIRCRAFT STATIONS**

1. Aircraft stations of any federal agency may use any aeronautical mobile (R) band frequency below 30 MHz for communication only with aeronautical stations regularly serving the routes or areas to which those frequencies are specifically allotted by international agreement. Further, any high frequency authorized by the Federal Communications Commission for aircraft stations may be employed by aircraft stations of any federal agency when communicating for safety purposes with aeronautical stations to which such frequencies are assigned, after arrangements have been made with the licensee of the non-federal aeronautical stations for this use.

2. Since military aircraft will use UHF in lieu of VHF to the maximum extent practicable, aircraft stations of any federal agency may use any frequency in the bands 117.975-123.0875, 123.5875-128.8125, and 132.0125-137.000 MHz for air traffic control, ground control, aeronautical advisory, aeronautical multicom, and flight service communication, as appropriate, only with aeronautical stations regularly serving the routes or areas to which those frequencies are authorized specifically. All operations by federal aircraft stations under the provisions of this paragraph shall be restricted to the purpose for which the particular frequency is allotted and authorized to the federal or non-federal aeronautical station.

3. All operations by federal aircraft stations under the provisions of the two preceding paragraphs shall comply with the appropriate provisions of Part 87 of the FCC Rules. Such provisions include, but are not limited to, those pertaining to power, type of emission, scope of service, permissible communications, and frequencies available, noting that the FCC does not issue type acceptance for equipment used aboard federal-owned and operated aircraft.

4. The frequency 122.925 MHz may be used with 6K00A3E emission by aircraft when coordinating natural resources programs of federal or state natural resources agencies, including forestry management and fire suppression, fish and game management and protection, and environmental monitoring and protection.

5. Radionavigation mobile stations aboard aircraft of any federal agency may utilize frequencies in the 1025-1150 MHz band to operate with directly associated ground-based facilities in Tactical Air Navigation (TACAN)/Distance Measurement Equipment (DME) and Air Traffic Control Radio Beacon (ATCRB) systems, and frequencies in the 4200-4400 MHz band to operate radio altimeters.

## **7.7 USE OF FREQUENCIES BY MANNED SPACECRAFT**

1. Stations aboard manned spacecraft may use the emergency, distress, survival craft, and search and rescue frequencies (2182 kHz, 3023 kHz, 5680 kHz, 8364 kHz, 121.5 MHz, 156.8 MHz and 243 MHz) of the aeronautical mobile and maritime mobile services for these purposes under the same rules and restrictions applicable to those services.

2. Article V of the United Nations Treaty on principles governing the activities of states in the exploration and use of outer space, including the Moon and other celestial bodies, provides that, “In carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other State Parties”. In furtherance of this obligation, Recommendation ITU-R SA.1863 has been adopted by the ITU. This Recommendation states that:

a. A manned spacecraft experiencing an emergency situation should use the 2290-2300 MHz band, excluding the 2293-2297 MHz sub band, to transmit to the Earth, directly and/or through a data relay satellite (DRS).

b. Transmissions to a manned spacecraft experiencing an emergency situation, either directly or through a DRS, should use the band 2025-2110 MHz or 2110-2120 MHz or both bands.

c. Unwanted emissions in the 2293-2297 MHz band from manned spacecraft emergency transmitters should meet the applicable deep space protection criteria stated in Recommendation ITU-R SA.1157.

## **7.8 PURCHASE AND USE OF NON-LICENSED DEVICES**

1. Federal Government agencies may, without further authority from the Assistant Secretary, purchase “off-the-shelf” non-licensed devices that conform to the applicable edition of Part 15 of the Federal Communication Commission's (FCC) Rules and Regulations (47 CFR, Part 15) or non-licensed devices for which the FCC has granted a waiver of specific requirements of Part 15. NTIA maintains the authority to forbid the operation of specific non-licensed devices for which the FCC has granted a waiver of Part 15 if NTIA deems the waiver to be inappropriate for the Federal Government. NTIA will identify in this section any such cases. The authorization stated in this section in no way abrogates the authority of any federal agency to forbid the operation of any non-licensed device by any user under its authority.

2. Non-licensed devices subject to FCC certification, notification or verification shall bear the appropriate FCC statement of limitations to operations. Agencies purchasing or using non-licensed devices for which the FCC has granted a waiver of specific requirements of Part 15, shall operate these devices in such a way as to meet all the conditions of the waiver.

3. The agency operating a non-licensed device that causes interference to an authorized radio station shall promptly take steps to eliminate the interference. Upon notification by cognizant spectrum management personnel that the device is causing interference, the operator of the non-licensed device shall cease all radiations from the device. Operations shall not resume until the condition causing the interference has been corrected.

4. Agencies operating a purchased non-licensed device have no vested or recognized right to continued use of the device in any part of the radio frequency spectrum. Non-licensed device operations must accept any interference from any federal or non-federal authorized radio station, other non-licensed device, or industrial, scientific and medical (ISM) equipment.

5. Non-licensed devices, since they operate on a non-interference basis, may not provide sufficient reliability for critical radio communications functions affecting human life or property. Non-licensed devices, however, may provide valuable and unique supplemental or expendable radio communications services where needed. To ensure adequate regulatory protection, federal entities should rely only on devices with frequency assignments in the Government Master File as principal radiocommunication systems for safeguarding human life or property.

## **7.9 DEVELOPMENT AND USE OF NON-LICENSED DEVICES**

1. Annex K is based on Part 15 of the FCC's Rules and Regulations (47 CFR, Part 15) which governs non-federal use of radio frequency devices that do not require an individual license to operate (i.e., “non-licensed devices”). Federal Government telecommunication operations do not require an FCC license or authorization. The term “non-licensed device” used in this Part refers only to federal devices - and operations of such devices - that conform to the technical criteria in Annex K.

2. Agencies may develop and operate devices that conform to the technical criteria in Annex K without further

authority from the Assistant Secretary. Additionally, any operational capability that conforms to the technical criteria in Annex K may be incorporated into otherwise authorized telecommunication systems without further authority from the Assistant Secretary.<sup>3</sup> The agency operating a device developed under the technical criteria of Annex K that causes interference to any authorized station shall promptly take steps to eliminate the interference. Upon notification by cognizant spectrum management personnel that the device is causing interference, the operator of the non-licensed device shall cease all radiations from the device. Operation shall not resume until the condition causing the interference has been corrected.

3. Agencies operating a device developed under the technical criteria of Annex K, have no vested or recognized right to continued use of the device in any part of the radio frequency spectrum. These devices must accept any interference from any authorized federal or non-federal radio system, other non-licensed device, or ISM equipment.

4. Non-licensed devices, since they operate on a non-interference basis, may not provide sufficient reliability for critical radio communications functions affecting human life or property. Non-licensed devices, however may provide valuable and unique supplemental or expendable radio communications services where needed. To ensure adequate regulatory protection, federal entities should rely only on devices with frequency assignments in the Government Master File as principal radiocommunication systems for safeguarding human life or property.

## 7.10 USE OF FREQUENCIES BY ISM EQUIPMENT

Without further authority from the Assistant Secretary, ISM equipment may be operated under the conditions specified in this part for particular categories of equipment or types of operations.

### 7.10.1 Operation on Particular Frequencies Designated for ISM Equipment

1. The following frequencies are designated for use by ISM equipment, the emissions of which shall be confined within the frequency limits associated with each frequency:

6780 kHz	± 15.0 kHz	5800 MHz	± 75.0 MHz
13560 kHz	± 17.0 kHz	24.125 GHz	± 125.0 MHz
27120 kHz	± 163.0 kHz	61.25 GHz	± 250.0 MHz
40.68 MHz	± 20.0 kHz	122.5 GHz	± 500.0 MHz
915 MHz	± 13.0 MHz	245 GHz	± 1.0 GHz
2450 MHz	± 50.0 MHz		

2. In the event that harmful interference is caused by ISM operation to any authorized radio service outside the frequency limits specified, the operator of the ISM equipment shall promptly take necessary steps to eliminate such interference, except in those cases where the interference is due to direct intermediate frequency pickup by a receiver of the fundamental frequency emissions of ISM equipment operating on an ISM frequency, and the operator otherwise complies with this section.

3. ISM equipment, other than industrial heating equipment, that is operated on the frequencies 915, 2450, 5800 MHz, and 24.125 GHz, is subject to the following conditions:

- a. The energy radiated and the bandwidth of emission shall be reduced to the maximum extent practicable.
- b. In the event that harmful interference is caused to authorized radio services from spurious or harmonic radiation from ISM equipment, the operation of the ISM equipment shall be discontinued until necessary measures have been taken to eliminate such interference.

4. Medical diathermy equipment may be operated on the designated ISM frequencies without regard to the type or power of emissions being radiated, except as specified above. However, any harmonic or other spurious radiation outside the frequency limits specified in this section shall be suppressed so as not to exceed a strength of 25  $\mu\text{V/m}$  at a distance of 300 meters. Measurements to determine field intensity shall be made in accordance with standard engineering procedures.

5. Industrial heating equipment and RF stabilized arc welders may be operated with unlimited radiation on any designated ISM frequency, but shall be adjusted to operate as close to that ISM frequency as practicable. Filtering between the industrial heating equipment and power lines must be provided to the extent necessary to prevent the radiation of energy from power lines on frequencies other than those designated for ISM, with a field strength in excess of 10  $\mu\text{V/m}$  at a distance of 1600 meters from the industrial heating equipment, and at a distance of 15 meters



from the power line.6. Miscellaneous ISM equipment may be operated on the designated ISM frequencies without regard to the type or power of emissions being radiated, provided any harmonic or other spurious radiation outside the frequency limits specified in this section is suppressed so as to not exceed:

- a. 25  $\mu\text{V/m}$  at a distance of 300 meters or,
- b. For equipment generating more than 500 watts of RF power on the fundamental frequency, 25  $\mu\text{V/m}$  times the square root of  $P/500$  (where  $P$  is the actual RF power generated), but not to exceed 10  $\mu\text{V/m}$  at 1600 meters, provided this increase is not permitted for equipment located in a predominantly residential area and operating on a frequency below 1000 MHz.

### 7.10.2 Operation on Frequencies Other than Those Designated for ISM Equipment

1. Operation of ISM equipment within the following safety, search and rescue frequency bands is prohibited: 490-510 kHz, 2170-2194 kHz, 8354-8374 kHz, 121.4-121.6 MHz, 156.7-156.9 MHz, and 242.8-243.2 MHz.

2. In the event harmful interference is caused to any authorized radio service outside the frequency limits specified in Section 7.10.1, by ISM operation conducted pursuant to this section, the operator of the ISM equipment shall promptly take the necessary steps to eliminate the interference.

3. Medical diathermy equipment shall be provided with a rectified and filtered plate power supply, powerline filters, and shall be constructed so that any radiated radio frequency energy (including harmonic or other spurious emissions) on a frequency outside the frequency limits specified in Section 7.10.1 does not exceed a strength of 15  $\mu\text{V/m}$  at a distance of 300 meters. Measurements to determine field intensity shall be made in accordance with standard engineering procedures.

4. Industrial heating equipment and RF stabilized arc welders may be operated provided all of the following conditions are met:

- a. Radiation on the fundamental carrier frequency, as well as spurious and harmonic radiations resulting from any source frequency, and falling outside the frequency limits specified in Section 7.10.1, shall be suppressed so that:

- (1) below 5725 MHz the field strength does not exceed 10  $\mu\text{V/m}$  at a distance of 1600 meters and;
- (2) above 5725 MHz it is reduced to the greatest extent practicable.

- b. Filtering between the industrial heating equipment and power lines shall be provided to the extent necessary to prevent the radiation of energy from power lines on frequencies other than the designated ISM frequencies, with a field strength in excess of 10  $\mu\text{V/m}$  at a distance of 1600 meters from the industrial heating equipment and at a distance of 15 meters from the power line.

5. Miscellaneous ISM equipment may be operated on frequencies other than those designated for ISM equipment provided all of the following conditions are met:

- a. The equipment shall be provided with a rectified and filtered plate power supply and power line filters.
- b. Any radiated radio frequency energy outside the frequency limits specified in Section 7.10.1 (including harmonic or other spurious emissions) shall not exceed:

- (1) 15  $\mu\text{V/m}$  at a distance of 300 meters; or,
- (2) for equipment generating more than 500 watts of RF power on the fundamental frequency, 15  $\mu\text{V/m}$  times the square root of  $P/500$  (where  $P$  is the actual RF power generated), but not to exceed 10  $\mu\text{V/m}$  at 1600 meters, provided this increase is not permitted for equipment located in a predominantly residential area and operating on a frequency below 1000 MHz.

6. Operation of ultrasonic equipment shall not result in radiation exceeding the following limits:

- a. Below 490 kHz  
2400  $\mu\text{V/m}$  at 300 meters/Frequency (in kHz)
- b. Between 490 and 1600 kHz  
2400  $\mu\text{V/m}$  at 30 meters/Frequency (in kHz)
- c. Over 1600 kHz (excluding frequencies within the limits specified in Section 7.10.1)  
15  $\mu\text{V/m}$  at 30 meters
- d. For equipment operating below 490 kHz and generating more than 500 watts of RF power on the fundamental frequency.

2400  $\mu\text{V/m}$  at 300 meters "Frequency (in kHz) times the square root of  $P/500$  (where  $P$  is the actual RF power generated), but not to exceed 10  $\mu\text{V/m}$  at 1600 meters", provided this increase is not permitted for equipment located in a predominantly residential area.

e. On any frequency 490 kHz and above, the radio frequency voltage appearing on each power line shall not exceed 200  $\mu$ V; below 490 kHz it shall not exceed 1000  $\mu$ V.

## 7.11 USE OF FREQUENCIES BY CERTAIN FEDERAL EXPERIMENTAL STATIONS

### 7.11.1 General

1. Subject to the provisions of subsections 7.11.2 and 7.11.3, certain federal experimental stations at the operating areas listed in subsection 7.11.3 are authorized to use any radio frequencies under a blanket assignment for station class EX without prior authorization through individual frequency assignments or Special Temporary Authorizations provided that:

- a. the nature or duration of the stations' operations are such that the assignment or authorization of specific frequencies is impracticable;
- b. all reasonable measures are taken before such frequencies are used to ensure that harmful interference will not be caused to authorized services, and, in this regard, consideration should be given to the propagation characteristics of the frequencies to be utilized and to the operational nature of the services normally operating on such frequencies;
- c. frequency use for the performance of electronic attack or countermeasures testing, training, and exercises is not authorized under this section (see Sections 7.14 and 7.25 of this Manual);
- d. operations comply with the conditions, and are confined to the sites, specified in subsection 7.11.3; and
- e. such testing and experiments are limited to stations belonging to and operated by the federal agency identified in subsection 7.11.3.

2. The authority provided under this section is limited to radio frequency usage which is an integral part of an experimental operation and shall not be construed as authorizing frequency usage for administrative or operational use related thereto. No priority rights shall derive from the use of a specific frequency for an operation conducted pursuant to this authority nor shall any specific frequency usage constitute a bar to the authorization of other uses.

3. Experimental operations conducted pursuant to this section shall be terminated immediately upon receipt of notice that harmful interference is being caused to an authorized service. To that end, the listings of the authorized sites in subsection 7.11.3 include sufficient point-of-contact information to permit the prompt delivery at all times of notices of harmful interference. Any agency, or the FCC on behalf of non-federal entities, may present to the Frequency Assignment Subcommittee (FAS) a report containing as much of the information as practicable (see paragraph 4 of section 8.2.30 of this Manual) when harmful interference is caused by an experimental radio station operating under this authority. Based on persistent documented reports of harmful interference, the FAS may recommend that NTIA suspend, amend, modify or revoke such authority.

### 7.11.2 Excluded Frequency Bands

1. The following frequency bands are specifically excluded from this authority:

kHz	MHz	GHz	
495.0-510.0	73.0-74.6	10.68-10.70	114.25-116.00
2173.5-2190.5	121.4-121.6	15.35-15.40	148.5-151.5
8354.0-8374.0	156.7-156.9	23.60-24.00	164.00-167.00
21850.0-21870.0	242.8-243.2	31.30-31.80	182.00-185.00
	608.0-614	50.2-50.4	190.00-191.80
	1400.0-1427.0	52.6-54.25	200.00-209.00
	1559.0-1610.0	86.00-92.00	226.00-231.5
	1660.5-1668.4	100.00-102.00	230.00-240.00
	2690.0-2700.0	109.5-111.8	250.00-252.00
	4990.0-5000.0		

2. Paragraph 1 shall not be construed as precluding the measurement of antenna characteristics in these excluded bands, provided that the power delivered to the antenna under test shall be for the sole purpose of

carrying out the desired measurements and shall be no greater than is required by the measurement technique being utilized.

### 7.11.3 Authorized Sites for Experimental Operations

1. In Annex C of this Manual is a list of authorized sites authorized for federal agencies to use for experimental radio stations provided that:

a. The point of contact identified in Annex C, or a responsible designated agency official, maintains a log (which shall be available to NTIA upon request) of experimental operations performed under this section and such log shall include, at a minimum; the dates, transmission start and end times, and frequencies used and;

b. At least 24 hours prior to planned experimental operations, notification is provided by electronic means (i.e., e-mail, phone call, or facsimile transmission) that includes the onsite Stop Buzzer contact name and phone number, frequencies to be used, and planned duration of use, to the FAA National Operations Control Center (NOCC) and the applicable DOD Area Frequency Coordinator (AFC) under the following conditions:

(1) to the FAA NOCC, NOCC@FAA.GOV if experimental operations will occur in or overlap with the following frequencies or frequency bands:

<u><b>kHz</b></u>	<u><b>MHz</b></u>
190-285	74.800-75.200
325-405	108.000-121.9375
415-435	123.0125-128.8125
510-535	132.0125-136.000
	328.600-335.400
	978-1020
	1030
	1031-1087
	1090
	1104-1146
	1157-1213
	1215-1390
	2700-2900
	5000-5250
	9000-9200

(2) to the applicable DOD AFC listed in Annex D, Table 3 of this Manual if experimental operations will occur in or overlap with the following bands: 1435-1525 MHz, 2310-2320 MHz and 2345-2390 MHz.

## 7.12 USE OF FREQUENCIES AUTHORIZED TO NON-FEDERAL STATIONS UNDER PART 90 OF THE FCC RULES

1. A federal radio station may utilize any frequency authorized to a non-federal radio station under 47 CFR, Part 90 of the rules of the Federal Communications Commission (FCC) where such utilization is necessary for intercommunication with non-federal stations or required for coordination with non-federal activities, provided that a) the frequency is associated with a non-federal National Interoperability Channel and the federal entity controlling the station has received approval from the FCC licensee involved, or b) in the cases of frequencies other than the non-federal National Interoperability Channels, a mutually approved arrangement has been concluded between the federal agency concerned, the FCC, and the non-federal licensee involved. All operations by federal stations under these provisions a) shall be conducted in essentially the same geographical area as those of the non-federal licensee, b) shall be restricted to the purpose for which the particular frequency is authorized to non-federal stations, c) shall be in accordance with the FCC rules and regulations, d) shall be subject to immediate termination if harmful interference is caused to the service rendered by non-federal stations, and e) shall not bar in any way the expansion of non-federal services for which the frequencies are allocated. The procedure for concluding a mutually-approved arrangement required by this provision is given in Section 8.3.3.

2. FCC regulations provide that non-federal stations holding a license for any public safety frequency pursuant to Part 90 of the Commission's rules are authorized the use of the federal interoperability channels in accordance

with Section 4.3.16. In addition, non-federal stations licensed by the FCC may be authorized the use of other frequencies assigned to federal radio stations upon appropriate showing by the applicant that such assignment is necessary for intercommunication with federal stations or required for coordination with activities of the Federal Government. Such provision is subject to determination by the FCC, after consultation with the appropriate federal agency or agencies, that the assignment is necessary.

### **7.13 MILITARY COMMUNICATIONS UNDER APPENDIX 13 (Part A2), INTERNATIONAL TELECOMMUNICATION CONVENTION**

1. Stations in the mobile service (including portable-type operations) of the U.S. Air Force, Army, Coast Guard, and Navy, when engaged in exercises or tactical operations, may employ any frequencies, in accordance with Appendix 13 (Part A2) of the International Telecommunication Convention provided they cause no interference with the authorized services operating on the frequencies selected.

2. When required by military necessity and in consonance with the provisions set forth in Appendix 13 (Part A2) of the International Telecommunication Convention, minimum performance requirements applicable to the use of Communications-Electronics equipment as prescribed in this Manual<sup>1</sup> may not be met.

3. Where under normal peacetime conditions harmful interference arises to (or from) other operations, performed in accordance with applicable regulatory provisions, as a result of such minimum performance requirements not being met, the military service(s) involved shall to the extent practicable take all reasonable measures to mitigate the harmful interference.

### **7.14 PERFORMANCE OF ELECTRONIC ATTACK FOR TESTS, TRAINING, AND EXERCISES**

1. Frequency use for the performance of electronic attack for tests, training, and exercises is governed by the most recent versions (and any supplements thereto) of the Chairman, Joint Chiefs of Staff (CJCS) Manuals entitled “Performing Electronic Attack in the United States and Canada for Tests, Training, and Exercises” and “Performing Tests, Training, and Exercises Impacting the Global Positioning System (GPS).” Compliance with these CJCS manuals is mandatory for all Department of Defense (DOD) components and contractors performing electronic attack tests, training, and exercises.

2. These CJCS manuals contain details concerning authorized frequency bands, geographical restrictions and frequency clearance procedures for conducting electronic attack tests, training, and exercises in the U.S. and its Territories and Possessions and in Canada. Release of these manuals is limited to DOD components (including the Combatant Commands) and other Federal agencies. Copies are available through controlled Internet access (limited to .mil and .gov users) from the CJCS Directives Electronic Library (<https://www.jcs.mil/library/>), from Joint Staff SIPRNET Directives Electronic Library, or from NTIA.

### **7.15 MILITARY COMMUNICATIONS FOR TACTICAL AND TRAINING OPERATIONS**

#### **7.15.1 Military Communications in the Bands 3500-4000, 20010-22000, and 22855-24990 kHz for Tactical and Training Operations**

1. To meet local military peacetime tactical and training requirements within the U.S. and Possessions (US&P), the military services may employ frequencies in the bands 3500-4000, 20010-22000, and 22855-24990 kHz on a secondary basis to the services of stations authorized on frequencies within these bands provided that:

- a. Operations shall be with field-type portable and mobile equipment.
- b. Minimum antenna power shall be used commensurate with the actual communication requirement but not in excess of 50 watts.
- c. The bandwidth of emission shall not exceed 6 kHz for the lower band or 36 kHz for the upper bands.
- d. Prior to transmission, responsible military personnel shall ascertain that services being performed in the

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<sup>1</sup> Necessary bandwidths as prescribed in Section 6.3.2. Frequency tolerance as prescribed in Section 5.1. Other minimum performance requirements as prescribed in Sections 5.5 and 5.6.

local area will not be disrupted or suffer harmful interference as a result of such military use of frequencies within the local area.

e. The use of any frequency authorized herein shall be terminated immediately upon notification that harmful interference is being caused.

### 7.15.2 Military Communications in the Broadcast Bands between 4 and 27 MHz, the Maritime Mobile Band between 4.005 and 4.063 MHz, and Specified Frequencies between 2 and 27 MHz for Tactical and Training Operations

1. The military services may employ frequencies in the bands as indicated in paragraph 1 below and specified frequencies in paragraph 2 below in order to meet local peacetime tactical and training requirements within the US&P (or as indicated below). Such use of frequencies shall be on a secondary basis and subject to the avoidance of harmful interference a) to all operations established in accordance with the international allocations applicable to those bands and b) to all other operations regularly authorized within the US&P on specific frequencies within those bands or on the specified frequencies.

2. The use of frequencies within the following bands will be conducted as indicated in subparagraphs a) and b) and with minimum antenna power commensurate with the actual communication requirement, but not to exceed the power for specific types of emission as indicated:

kHz	kHz
4005 – 4063	5950 - 6200
13600 - 13800	15100 – 15600
9500 - 9900	21450 - 21850
	25670 - 26100

a. For field portable and mobile equipment the following parameters apply:

1K10F1B	100 watts mean
100HA1A	200 watts peak
3K00J3E	250 watts peak
2K00A2B	300 watts peak
3K00J7B, 4K00J7B	400 watts peak
3K00J9W, 4K00J9W, 6K00J9W	600 watts peak
6K00B9W	800 watts peak

b. For shipboard mobile equipment the following parameters apply:

100HA1A	500 watts peak
100HJ2A	500 watts peak
3K00J3E, 2K80J3E	500 watts peak
3K00J7B	1000 watts peak
6K00B9W	2000 watts peak

3. The use of the following frequencies, as indicated below, will be controlled by and coordinated between the Military Departments Frequency Management Offices for operations conducted a) normally between transportable and fixed facilities engaged in long haul HF operations and b) with minimum antenna power commensurate with the actual communication requirement, but not to exceed 10 KW, and with 6K00B9W, 9K00B9W and 12K00B9W emissions only (**all in kHz**).

2001.0	6897.5 <sup>(1)</sup>	9958.0	13545.0	17500.0	20763.0
2582.0*	6905.0	9970.0 <sup>(4)</sup>	13610.0 <sup>(4)(10)</sup>	17519.0 <sup>(3)</sup>	20950.0 <sup>(5)</sup>
2618.0 <sup>(9)</sup>	6912.5	10586.0 <sup>(2)</sup>	13680.0 <sup>(10)*</sup>	18036.0 <sup>(1)</sup>	21856.0 <sup>(6)</sup>

2664.0 <sup>(12)</sup>	6989.0	10690.0	14375.0	18060.0	21886.0 <sup>(6)</sup>
2797.0*	7362.5 <sup>(5)</sup>	10720.0 <sup>(5)</sup>	14385.0	18162.5 <sup>(11)</sup>	21918.0 <sup>(6)</sup>
3373.0	7469.0 <sup>(1)</sup>	10730.0	14646.0	19005.0	23180.0
4445.0	7690.0 <sup>(1)</sup>	11410.0 <sup>(6)</sup>	14667.0 <sup>(6)</sup>	19047.0	23500.0
4505.0 <sup>(4)</sup>	7935.0	11422.5 <sup>(5)</sup>	14867.5	19160.0	23600.0
4528.0	8000.0 <sup>(5)</sup>	11482.5	15595.0 <sup>(1)(10)</sup>	19510.0 <sup>(4)</sup>	23690.0
4562.5	8041.0	11513.5 <sup>(4)</sup>	15895.0	20035.0	23700.0
4595.0 <sup>(6)</sup>	8060.0	11535.0	16090.0	20050.0	24120.0
4985.0 <sup>(4)</sup>	8064.0	11995.0 <sup>(10)</sup>	16100.0	20075.0	24510.0
5370.0 <sup>(4)</sup>	8162.0 <sup>(10)</sup>	12045.0 <sup>(2)(10)</sup>	16170.0	20124.0	25360.0
5400.0 <sup>(3)</sup>	8170.0 <sup>(10)</sup>	12060.0	16225.0 <sup>(5)</sup>	20171.0	25425.0
5434.0	9145.0	12090.0	16340.0	20350.0 <sup>(8)</sup>	25516.0
5817.5 <sup>(2)</sup>	9190.0 <sup>(3)(9)</sup>	12105.0	16422.5 <sup>(6)(10)</sup>	20400.0	26575.0 <sup>(9)</sup>
5820.0 <sup>(2)</sup>	9259.0 <sup>(7)</sup>	12240.0 <sup>(10)</sup>	17410.0 <sup>(1)(8)(10)</sup>	20425.0	26650.0 <sup>(5)</sup>
5835.0*	9320.0 <sup>(4)</sup>	12255.0 <sup>(2)(10)</sup>	17460.0	20438.0 <sup>(5)</sup>	26750.0
6830.0	9417.5	12324.0 <sup>(4)(10)</sup>	17480.0	20550.0	26850.0

\* 6KB9W and 9KB9W only

<sup>1</sup> Transmit east of 100° west only

<sup>2</sup> Transmit west of 100° west only

<sup>3</sup> Transmit east of 117° west only

<sup>4</sup> Transmit west of 117° west only

<sup>5</sup> NAVCOMMSTA Stockton transmit only

<sup>6</sup> USA to USA only

<sup>7</sup> Not to be used to/from Norfolk, VA

<sup>8</sup> Military services to coordinate with Justice before use

<sup>9</sup> 6KB9W only

<sup>10</sup> This frequency is available until implementation procedures and schedules are determined by future conferences of the International Telecommunication Union (ITU) for Broadcasting or Maritime Mobile Services.

<sup>11</sup> This frequency is available until re-accommodation actions of the International Telecommunication Union (ITU) are completed or until July 1, 1989, whichever is earlier.

<sup>12</sup> For use within central U.S. Coordinate with Coast Guard prior to use near Coast Guard/Coastal areas.

### 7.15.3 Military Communications in Non-Federal Bands Above 25 MHz for Tactical and Training Operations

4. The military services may employ frequencies in certain non-federal bands above 25 MHz, after coordination between the FCC's FAS Liaison representative and military field personnel, for tactical and training operations in the US&P. The military use of non-federal frequencies under the procedures stipulated will not be a bar to the present or future assignment, through the normal IRAC/FCC process, of non-federal frequencies to non-military federal agencies, and, in such military use of non-federal frequencies, protection shall be afforded to federal operations authorized on specific frequencies within the non-federal frequency bands concerned.

5. In order to provide for military tactical and training assignments in the US&P, military field personnel are authorized to coordinate such assignments with the FCC's FAS Liaison representative without referring these matters to Washington headquarters.

6. Military agencies have agreed that prior to coordinating tactical and training frequency assignments with the FCC's FAS liaison representative, military field representatives will first establish that proposed assignments have a good chance of being compatible with non-federal assignments. Consequently, the FCC is not expected to "engineer" such assignments for the military.

7. The following procedures will apply to the use of the non-federal bands between 25 and 2400 MHz specified herein:

- a. The military will not request the use of frequencies allocated to non-federal services whenever the tactical and training requirements can be met through the use of federal bands.
- b. Military tactical and training assignments shall cause no harmful interference to non-federal assignments

and military operations shall be terminated immediately upon notification that harmful interference has occurred.

c. Military tactical and training assignments must accept such interference as may be caused by non-federal spectrum use.

d. Tactical and training assignments shall be temporary for a period of no longer than 1 year and the military representatives shall re-coordinate if continued use is desired. The military field representatives shall maintain a current list of such assignments and furnish the list to the FCC's FAS liaison representative if requested.

8. The following shall be used as a guide for the coordination of military tactical and training assignments when it has been determined that the use of non-federal bands is necessary:

a. Bands allocated to the broadcasting service for domestic use.

(1) The following are the bands between 25 and 2400 MHz that are allocated for this purpose:

<b>MHz</b>	<b>MHz</b>
54-72	174-216
76-100 (ex. Alaska)	470-608
100-108	614-698

(2) The FCC will not permit military tactical and training assignments on TV or FM channels in the areas where the public is receiving service. In many instances such service is received far beyond the normal service ranges of broadcasting stations. However, reception in such areas shall be protected regardless of the quality of such reception

b. Bands used for auxiliary broadcast purposes.

(1) The following are the bands between 25 and 2400 MHz that are allocated for this use:

<b>MHz</b>	<b>Use</b>
25.85-26.48	Remote Pickup
152.86-153.35	Remote Pickup
160.86-161.40	Remote Pickup (Puerto Rico and Virgin Islands only)
161.625-161.775	Remote Pickup (except in Puerto Rico and Virgin Islands)
450-451	Remote Pickup
455-456	Remote Pickup
942-952	STL
2025-2110	TV Pickup, TV-STL

(2) Frequencies in bands used by remote pickup, studio transmitter links and other broadcast auxiliaries may be used for military tactical and training purposes providing FCC engineers coordinate such use with the appropriate broadcast station licensees. For example, there is no objection to a military tactical and training assignment co-channel to a remote pickup assignment in the same area provided the broadcast licensee is cognizant of such arrangements and can be assured that in the event a remote broadcast pickup is necessary, any military operations that may be on the air will shut down immediately upon notification.

As an additional example, frequencies which are assigned to studio transmitter links may be utilized by military tactical and training assignments, providing these assignments are coordinated by the FCC with the broadcast licensees involved and the tactical and training assignments so arranged as to cause no harmful interference to an STL. In all cases where a tactical and training assignment is made on an auxiliary broadcast service frequency within interference range of a co-channel FCC licensee, the licensee should be given the name of the military representative to contact in the event interference is caused.

c. Public Safety, Citizens Radio, Industrial, Land Transportation and Maritime Mobile Bands.

(1) The following bands between 25 and 2400 MHz are allocated for this purpose:

<b>MHz</b>	<b>MHz</b>	<b>MHz</b>
25.01-25.33	39.00-40.00	156.675-156.725
26.96-27.54	42.00-43.20	156.875-157.025
29.70-29.80	43.68-46.601	157.45-157.74
30.56-32.00	47.00-49.60	158.10-158.46
33.00-34.00	150.80-152.00	158.70-161.775

35.00-35.20	152.24-152.48	173.20-173.40
35.68-36.00	152.84-156.25	451.00-454.00
37.00-38.00	156.325-156.625	456.00-459.00
		460.00-470.00

(2) Frequencies in bands allocated to these services for land mobile use may be authorized for military tactical and training assignments provided the assignments are coordinated between FCC field engineers and military field representatives. Consequently, personnel in the field will need to take into consideration such factors as local terrain. For example, an obstruction such as a hill or a mountain range might lower considerably the distance between a non-federal and a military tactical and training assignment. On the other hand, there are certain locations where better than average radio propagation conditions exist, and it will be necessary for FCC engineers and military representatives to take this into account. If doubt exists as to the practicability of a proposed tactical and training assignment, tests should be conducted.

d. Bands allocated to non-federal fixed service (excluding common carriers).

(1) The following are the bands between 25 and 2400 MHz that are allocated for this purpose:

<b>MHz</b>	<b>MHz</b>
72.0-73.0	1850-2000
75.4-76.0	2020-2200
76.0-100 (In Alaska)	
952-960	

(2) In bands allocated to the non-federal fixed service (excluding common carrier), military tactical and training assignments may be authorized after coordination with the FCC's FAS Liaison representative. It is not possible to develop typical standards for the coordination of such assignments in fixed bands due to the fact that, in general, highly directive antennas are used and problems of interference protection will vary greatly. Since many military tactical and training operations involve the use of highly directive antennas, it may sometimes be possible to coordinate such assignments, although they may be in the same area as non-federal assignments, by taking into account directive antenna features of the installations involved. In coordinating such assignments FCC engineers may coordinate proposed military tactical and training assignments with FCC licensees whenever there is a doubt as to the compatibility of the proposed military assignments. Tests should be conducted if necessary.

e. Bands allocated to international fixed public services.

(1) The following bands between 25 and 2400 MHz are allocated for this purpose:

<b>MHz</b>
26.95-26.96
29.80-29.89
29.91-30.00

(2) In the above bands, military tactical and training assignments may be authorized after coordination with the FCC's FAS Liaison representative provided that the military use is limited to those periods when propagation conditions would not normally support long distance communication, and therefore could be expected to confine to the local area the potential of interference to non-federal services.

f. Amateur Bands

(1) The following are the bands between 25 and 2400 MHz that are allocated for this purpose:

<b>MHz</b>	<b>MHz</b>
28-29.7	420-450
50-54	902-928
144-148	1240-1300
219-220	2300-2310
222-225	2390-2400 (This band extends to 2450 MHz.)

(2) The following provisions are applicable in the use of the above bands for communication purposes



(i.e. for other than radiolocation purposes).

(a) Subject to the provisions of the rules adopted by the Federal Communications Commission, amateur stations generally are operated freely on any frequency within the established amateur bands. Therefore, great care needs to be taken in the coordination and in the use of such frequencies by the military.

(b) The following conditions shall be observed in the military use of amateur frequency bands between 25 and 2400 MHz for routine day to day tactical and training purposes:

i. Operations on such frequencies will be confined normally to the hours of 0600-1800 local civil time.

ii. Prior to transmission on specific frequencies, military personnel should ascertain that such frequencies are not in actual use by amateur stations within the local area in a manner which is likely to suffer harmful interference if the frequencies were used for military operation.

iii. In recognition of the primary status of amateur stations as against the secondary status of military frequency use in such bands in peacetime, military personnel have responsibility in the event of, evidence of, or actual complaints of interference, to take effective remedial action without undue delay<sup>2</sup>.

iv. Insofar as practical, consideration should be given in planning the use of such frequencies to their employment in a manner or at transmitter locations well removed from areas of civilian population where amateur use is likely. Appropriate measures should be adopted to minimize interference as by the use of minimum radiated power and intermittent transmissions of short duration.

v. It should be recognized that long distance propagation characteristics of the 28 MHz and 50 MHz bands, especially in the case of the former, require that good judgment be exercised in military use of these bands. Only when sky-wave propagation is not present is it practicable to use these bands for anything except extremely low power

#### **7.15.4 Military Communications in the Federal Bands Between 30 and 50 MHz for Tactical and Training Operations**

To meet local military peacetime tactical and training requirements within the US&P, the military services may employ frequencies in the bands 30.00 to 30.56, 32.00 to 33.00, 34.00 to 35.00, 36.00 to 37.00, 38.00 to 39.00, 40.00 to 42.00, 46.60 to 47.00, and 49.60 to 50.00 MHz on a secondary basis to the services of other federal stations authorized on frequencies within these bands provided that:

a. Operations shall be with field-type portable and mobile equipment.

b. Minimum antenna power shall be used commensurate with the actual communication requirement but not in excess of 50 watts.

c. The bandwidth of emission shall not exceed 6 kHz with type A3E emission or 36 kHz with type F3E emission.

d. Prior to transmission, responsible military personnel shall ascertain that services being performed by other federal agencies in the local area will not be disrupted or suffer harmful interference as a result of such military use of frequencies within the local area.

e. The use of any frequency authorized herein shall be terminated immediately upon notification that harmful interference is being caused.

#### **7.16 (RESERVED)**

#### **7.17 MILITARY COMMUNICATIONS AT TEST RANGES IN NON-FEDERAL BANDS ABOVE 25 MHz**

The military departments may employ frequencies in certain non-federal bands above 25 MHz at specified military test ranges after coordination between FCC field personnel and military field personnel.

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<sup>2</sup> This refers to military use for communication purposes and not to military radio location uses which have priority status in the amateur bands above 222 MHz.

### 7.17.1 Locations

The military test ranges and the Geographical Areas of Cognizance are as follows:

Activity	Geographical Area of Cognizance	Service Responsibility
Weapons and Tactics Center, Nellis AFB, Nevada	Entire State of Nevada plus Utah west of 111° W and Idaho South of 44°N.	Air Force
Air Force Eastern Test Range, Patrick AFB, Florida	Area bounded by 24°N, 31°30'N, 77°W, and 83°W.	Air Force
DOD Gulf Area Coordinator, Eglin AFB, Florida	Area bounded by 24°N, 33°30'N, 83°W and 90°W.	Air Force

Activity	Geographical Area of Cognizance	Service Responsibility
Pacific Missile Test Center, Pt. Mugu, California	Area enclosed within 322 kilometer radius of Headquarters Building, PMR, and the area of California that lies south of 37°30'N.	Navy
Army Electronic Proving Ground, Ft. Huachuca, Arizona	Entire State of Arizona	Army
Military Ranges within the State of Hawaii	Area enclosed by 322 kilometer radius of Honolulu, Hawaii	CINCPAC
White Sands Missile Range, Las Cruces, New Mexico	Entire State of New Mexico and other U.S. territory enclosed with a 240 kilometer radius of the Headquarters Building, WSMR, plus the area of the States of Utah and Colorado that lies south of 41°N and between 108°W and 111°W.	Army
Military Ranges within the State of Alaska	Entire State of Alaska	USPACOM

### 7.17.2 Frequency Bands

Frequencies in the following bands may be used in these geographical areas in support of the mission of these ranges, subject to the conditions and procedures specified in this part (**all in MHz**):

25.01-25.33	35.00-36.00	144.0-148.0	450.0-608.0
25.85-26.48	37.00-38.00	150.8-156.25	614.0-890.0
26.95-27.54	39.00-40.00	156.35-156.7	942.0-960.0
28.00-29.89	42.00-46.60	156.9-157.0375	1850-2110
29.91-30.00	47.00-49.60	157.1875	2450-2690
30.56-32.00	50.00-73.00	162.0125	6425-7125
33.00-34.00	75.40-108.00	174.0-216.0	10550-10680
			11700-13250

Frequency bands above 13250 MHz are under consideration and will be designated later.

### 7.17.3 Conditions

1. Non-federal allocated bands will not be used if the frequency requirements can be satisfied in federal allocated bands.
2. Proposed operations on non-federal frequencies should normally be limited to those of a highly intermittent nature which can be suspended or adjusted immediately upon notice that interference is being caused to a non-federal service. Care should be exercised in the selection of frequencies for proposed operations to avoid the likelihood of harmful interference to known non-federal operations. Where practicable, provision shall be made for identification of the transmissions of the military station either by the transmission of a call sign or periodic interruption of the

transmissions in accordance with a prearranged schedule.

3. Military users of any frequency assigned pursuant to this procedure shall accept any interference that may be caused by non-federal services, shall not cause interference to any non-federal service, and shall not preclude new non-federal assignments on such a frequency.

4. This procedure does not apply to the development of military systems or concepts which may require changes in the National Table of Frequency Allocations. Any such development must be coordinated through appropriate Washington channels.

#### **7.17.4 Coordination**

1. Proposed federal operations on non-federal frequencies which come within the purview of this procedure shall be coordinated with the FCC's Office of Engineering and Technology, Chief of Spectrum Coordination Branch, prior to the commencement of such operation. No operation on non-federal frequencies shall be conducted without prior concurrence by the FCC Chief of Spectrum Coordination Branch. If the FCC Chief of Spectrum Coordination Branch is unable to concur in a proposed operation and circumstances appear to warrant further consideration by higher authority, the request may be referred to military headquarters.

2. Requests for coordination submitted to the FCC Chief of Spectrum Coordination Branch shall include the following information:

- a. Security classification, if any.
- b. Frequency or frequencies proposed to be used.
- c. Transmitter location or area of proposed operation. (If the transmitter is at a fixed location, give the geographic coordinates to the nearest minute as well as the nearest identifiable community. If the operation is portable or mobile, describe the area of proposed operation. If the transmitter is airborne, so specify and describe the general range of operations.)
- d. Emission and bandwidth. (If pulsed emissions are used, give the approximate risetime and repetition rate.)
- e. Power. (Output power of transmitter.)
- f. Antenna. (Give type of antenna (whip, dipole, yagi, parabolic, etc.) approximate height of antenna above ground, power gain if any, and direction of main radiation lobe if a directive transmitting antenna is employed.)
- g. Time of operation. (To the extent practicable, indicate whether the proposed operation will take place at specified hours or during certain periods of the day, whether the transmissions during operation will be continuous or intermittent with some indication as to the degree of intermittence, and whether the contemplated use will occur frequently or only upon special occasions. Such information will assist the Chief of Spectrum Coordination Branch in properly evaluating potential interference.)
- h. Call signs. (Call sign information should be supplied, if appropriate. If identification is to be accomplished through periodic interruptions of the transmissions in accordance with a prearranged schedule, supply such a schedule.)
- i. Expected duration of the proposed operation.
- j. Remarks. (Any additional information which will be helpful in assessing potential interference.)

3. Military frequency coordinators shall not coordinate proposed frequencies with the FCC until it has been ascertained, to the coordinator's satisfaction, that the terms of this document can be met.

#### **7.17.5 Frequency Assignment Lists**

On an annual basis the military frequency coordinators will furnish in duplicate to the appropriate FCC Chief of Spectrum Coordination Branch a list of current assignments made pursuant to these arrangements.

### **7.18 MILITARY TELEMETERING AND TERRESTRIAL TELECOMMAND IN RADIOLOCATION BANDS**

In order to transmit command signals to airborne vehicles being tracked and to receive status information from the vehicles, military telemetering and terrestrial telecommand operations are authorized in the bands 3100-3650, 5250-5925, 8500-10,000 MHz, 13.4-14.0 and 15.7-17.3 GHz when conducted as an integral part of the operation of authorized stations in the radiolocation service. Such telemetering and terrestrial telecommand operations shall be

on a secondary basis to authorized stations operating in accordance with the National Table of Frequency Allocations.

## **7.19 (RESERVED)**

## **7.20 USE OF NON-FEDERAL FREQUENCIES BY THE FCC ENFORCEMENT BUREAU**

The FCC Enforcement Bureau is authorized to transmit on any frequency that is allocated or authorized for non-federal use under FCC Rule Parts 2, 15, 18, 22, 24, 25, 27, 30, 73, 74, 76, 78, 80, 87, 90, 95, 96, 97 and 101 for the purpose of enforcement and/or interference resolution.

## **7.21 TEMPEST ZONE TESTING OF PHYSICAL FACILITIES**

1. Federal stations are authorized to transmit necessary emissions for TEMPEST zone testing in the frequency range 10 to 1000 MHz on a non-interference basis to other operations in this band. These TEMPEST zone tests shall be conducted with the following restrictions:

a. The frequency range 10-1000 MHz will be broken into 4 bands for testing: 10-110 MHz, 100-200 MHz, 200-500 MHz and 500-1000 MHz. A bi-conical antenna will be used for 10-200 MHz. A log periodic antenna will be used above 200 MHz.

b. Testing will be done with a signal generator which produces a continuously swept sine wave. Sweep durations will not exceed two seconds for bands 10-110 and 100-200 MHz; or 5 seconds for the band 200-500 MHz; or 10 seconds for the band 500-1000 MHz.

c. The transmitting antenna will always be inside a building, and power will not exceed 3.5 watts input to the antenna.

2. Prior to conducting a test, coordination by the test agency's FAS representative shall be effected with FAS representatives of all federal agencies and the FCC whenever such tests could affect their radio stations or FCC licensees.

3. Non--federal stations conducting TEMPEST zone testing under contract should apply for license under Part 5 (Experimental Radio Services) of the FCC Rules. These operations shall be coordinated with the contracting agency and other federal agencies by the FCC FAS representative, as appropriate.

## **7.22 USE OF FREQUENCIES 10.525 GHz AND 24.150 GHz OR THE BAND 33.4-36.0 GHz FOR RADIOLOCATION DEVICES**

Federal agencies may operate radio units for the purpose of determining distance, direction, speed or position by means of a radiolocation device on the frequencies 10.525 GHz and 24.150 GHz or in the band 33.4-36.0 GHz, provided FCC type-accepted equipment or equipment developed with identical standards or specifications is used.

## **7.23 FEDERAL GOVERNMENT AGENCIES AS END USERS OR CUSTOMERS OF FCC-LICENSED SERVICES**

1. Federal Government entities may, without further authority from the Assistant Secretary or NTIA, use the radio frequency spectrum for telecommunication as end users or customers of any FCC-licensed system or service so long as the operation of the federal entities' radio frequency devices and equipment is under the control of the FCC licensee; does not require an individual FCC license; and such devices, equipment, and uses are in accordance with applicable FCC rules and regulations.

2. In addition, Federal Government entities may, without further authority from the Assistant Secretary or NTIA, use the radio frequency spectrum for telecommunication as end users or customers in any FCC service that is licensed by rule so long as the federal entities' radio frequency devices, equipment, and uses are in accordance with applicable FCC rules and regulations.

3. The blanket authority addressed by this section covers licensed services, including those licensed by rule, contained in Title 47 of the Code of Federal Regulations.

4. Federal end users and customers covered by this section may be accorded the same privileges and are subject to the same obligations as non-federal end users and customers.

5. For services that, under applicable rules, provide no customer or end-user protection from harmful interference caused by another authorized user, federal entities may not use such services to support operations that safeguard human life or property.

6. This section does not relieve federal users from any applicable policy, guidance, or regulations issued by their agencies governing the use of such devices, equipment, or services.

## **7.24 (RESERVED. SEE CHAPTER 12.)**

## **7.25 USE OF ELECTRONIC ATTACK AND ELECTRONIC COUNTERMEASURES**

### **7.25.1 General; Coordination; Definitions**

1. The use of stations or devices designed or intended to cause harmful interference to electromagnetic communications is prohibited unless specifically authorized by law and such use is in accordance with this section, Section 7.14 of this Manual, or a separate authorization from the National Telecommunications and Information Administration (NTIA).

2. To the extent such stations or devices are so authorized and used by a federal agency, close coordination with NTIA, the Federal Communications Commission (FCC), the Federal Aviation Administration (FAA), and any other potentially affected federal agencies is required to facilitate safe and effective use of these stations and devices and to minimize collateral risk of interference to other authorized users of the radio frequency spectrum. For purposes of such coordination, the authorized agency shall provide all required or requested information to at least the following:

- a. NTIA, Office of Spectrum Management, Frequency Assignment Branch (FAB):  
FAB@ntia.gov (unclassified only)  
FAB@doc.sgov.gov (SIPRNET)  
Confirm receipt at 202-482-1132
- b. FCC Operations Center (24/7):  
FCCOPS@fcc.gov (unclassified only)  
FCCOPS@saber.pentagon.smil.mil (SIPRNET)  
Confirm receipt at 202-418-1122
- c. FCC Office of Engineering and Technology, Spectrum Coordination Branch:  
OET-SCB@fcc.gov (unclassified only)  
Confirm receipt at 202-418-2470
- d. FAA  
FAA-DOD-LIAISON@faa.gov (unclassified only)  
FAA-DOD\_Liaison@faa.sgov.gov (SIPRNET)  
Confirm receipt with Military Team Lead at 202-595-4624 or 202-267-8584 or with Military Liaison at 202-603-4965 or 202-267-5981

3. For purposes of this section, the terms “electronic attack” (EA) and “electronic countermeasures” (ECM) have the meanings given those terms in the documents referenced below. However, in the absence of definitions in those documents, these terms mean the operational deployment of devices, equipment, or techniques with the objective of intentionally disrupting the operation, operational effectiveness, or performance of electronics and electrical equipment through the use of jamming, electromagnetic energy, or directed energy to cause harmful interference.

### **7.25.2 Use of EA and ECM by the Department of Justice in Response to Radio-Controlled Improvised Explosive Devices**

1. The Department of Justice (DOJ) is authorized to conduct EA and ECM operations in accordance with the most recent version of the DOJ document entitled “Authorization of Radio Transmission and the Control of Interference Applicable to the Department of Justice Program for Applying Electronic Countermeasures in the United States in Response to Threats of Radio-Controlled Improvised Explosive Devices.”

2. This document contains details of a Federal Bureau of Investigation (FBI) sponsored ECM program

designed to address the requirements of bomb squads in response to radio-controlled improvised explosive devices. The DOJ document describes required training and certification procedures for program participants, identifies the type of equipment to be used (along with requirements for tracking, replacement, and retirement of such equipment), and summarizes the general program limits and safeguards such as coordination and reporting requirements for frequency management and interference mitigation and control.

3. This document is only approved for limited release to the program's sponsors and contractors, to trained and certified program participants, and to other federal agencies in connection with the program. Copies are available to approved entities only through a controlled distribution by the FBI or from NTIA. DOJ will review this document annually and provide updates to NTIA accordingly.

### **7.25.3 Use of EA and ECM by the Military Departments in Response to Threats Posed by Unmanned Aircraft Systems and Unmanned Aircraft to Covered Facilities and Assets**

1. The military departments are authorized to conduct EA and ECM operations against Unmanned Aircraft Systems (UAS) and Unmanned Aircraft (UA) in accordance with Section 130i of Title 10, United States Code, as amended, and applicable regulations and guidance documents issued thereunder.

2. Such guidance documents and other applicable directives and policies set forth, among other things, detailed requirements and procedures that govern the use of EA and ECM against UAS/UA, including measures to prevent and mitigate collateral impacts and unintended harmful interference. These measures include coordination and notification requirements and procedures for obtaining specific frequency clearances. These documents also outline operator training, equipment tracking and control, and "stop buzzer" notification requirements.

3. Release of the aforementioned documents is limited to the military departments, other Department of Defense (DOD) components (including the Combatant Commands) and other federal agencies. Copies are available only through a controlled distribution by DOD or by NTIA pursuant to its document distribution procedures.

### **7.25.4 Use of EA and ECM by the Department of Energy in Response to Threats Posed by UAS and UA to Covered Nuclear Facilities and Assets**

1. The Department of Energy (DOE) is authorized to conduct EA and ECM operations against UAS and UA in accordance with Section 2661 of Title 50, United States Code, and applicable regulations and guidance documents issued thereunder.

2. Such guidance documents and other applicable directives and policies set forth, among other things, detailed requirements and procedures that govern the use of EA and ECM against UAS/UA, including measures to prevent and mitigate collateral impacts and unintended harmful interference. These measures include coordination and notification requirements and procedures for obtaining specific frequency clearances. These documents also outline operator training, equipment tracking and control, and "stop buzzer" notification requirements.

3. Release of the aforementioned documents is limited to DOE and other federal agencies. Copies are available only through a controlled distribution by DOE or by NTIA pursuant to its document distribution procedures.

### **7.25.5 Use of EA and ECM by the Departments of Justice and Homeland Security in Response to Threats Posed by UAS and UA to Covered Facilities and Assets**

1. The Department of Justice (DOJ) and the Department of Homeland Security (DHS) are authorized to conduct EA and ECM operations against UAS and UA in accordance with Section 124n of Title 6, United States Code, and applicable regulations and guidance documents issued thereunder.

2. Such guidance documents and other applicable directives and policies set forth, among other things, detailed requirements and procedures that govern the use of EA and ECM against UAS/UA, including measures to prevent and mitigate collateral impacts and unintended harmful interference. These measures include coordination and notification requirements and procedures for obtaining specific frequency clearances. These documents also outline operator training, equipment tracking and control, and "stop buzzer" notification requirements.

3. Release of the aforementioned documents is limited to DOJ, DHS, and other federal agencies. Copies are available only through a controlled distribution by DOJ, DHS, or NTIA pursuant to their document distribution procedures.

## **7.25.6 Use of EA and ECM for Testing and Evaluation of EA and ECM Equipment**

1. Unless otherwise authorized by Section 7.14 of this Manual or any of the above provisions of this section, federal agencies engaged in research, development, testing, and evaluation of technologies and equipment for purposes of EA or ECM must conduct all over-the-air testing and evaluation of such technologies and equipment in accordance with the following provisions under a pre-coordinated special temporary authorization (STA) obtained from NTIA pursuant to Section 8.3.31 of this Manual.

2. Notwithstanding the provisions of Section 8.3.31 and to facilitate close coordination with NTIA, FCC, FAA, and other agencies, the following additional requirements (with reference to the corresponding paragraph in Section 8.3.31) shall apply to any federal agency STA request for testing and evaluation of EA and ECM equipment:

a. Timing (per para. 3 of Sec. 8.3.31). NTIA may provide, at its discretion, more than five (5) business days to circulate such requests among impacted users to ensure adequate interagency review and coordination. No “emergency” STA requests for EA and ECM testing and evaluation operations will be accepted. It is strongly recommended that such requests be:

(1) Submitted to NTIA at least sixty (60) days prior to the requested start date of the proposed operation, if possible, but no such requests shall be submitted later than thirty (30) days before the proposed start date;

(2) Pre-coordinated (per para. 7(a) of Sec. 8.3.31) directly with the FAA contacts in para. 2(d) of Section 7.25.1 above and any other affected federal agencies if the requested bands (or in the case of significant emissions outside of such bands) overlap those in which the FAA and other affected agencies have potential victim assignment(s) (e.g., frequency bands listed under the Aeronautical Advisory Group in Section 1.3.2 and in Section 8.3.16 of this Manual);

(3) Pre-coordinated (per para. 7(b) of Sec. 8.3.31) directly with the FCC contacts in para. 2(b)-(c) of Section 7.25.1 above if the requested bands overlap any non-Federal allocation listed in the National Table of Frequency Allocations under Part 2 of the FCC’s rules (including bands used for unlicensed devices, such as ISM bands at 902-928 MHz, 2.4 GHz, and 5 GHz) or non-Federal authorized use listed in the Table; and

(4) Pre-coordinated (per para. 7(b) of Sec. 8.3.31) directly with potentially affected FCC licensees especially when proposed testing will occur near populated areas.

b. Stop Buzzer Information (per para. 4 of Sec. 8.3.31). Stop buzzer contact information shall be included in the STA request, updated as necessary, and provided to the NTIA, FCC, and FAA contacts in para. 2 of Section 7.25.1 above (and to other potentially affected federal agencies). Such information shall include primary and backup phone numbers and e-mail addresses of on-site federal agency personnel who have authority and ability to shut down testing and evaluation operations in the event of reported interference.

c. Use of Assets Already in the Government Master File (GMF) (per para. 5 of Sec. 8.3.31). Upon request, NTIA may waive this requirement.

d. Additional Data Requirements (per para. 6 of Section 8.3.31). NTIA, at its discretion or upon request from the FCC, FAA or other potentially impacted agencies, may require additional data from the requesting agency, including but not limited to: specific data on emissions outside of the requested bands, frequency agility, power reductions, site location, terrain, direction of transmissions; identification of known population centers that could be affected by the testing; a copy of the test plan; and applicable federal contract or cooperative agreement numbers and contracting officer’s point of contact information.

## **7.26 AUTHORIZATION TO UTILIZE SPECTRUM BY FEDERAL SURFACE DEFECT TESTING SYSTEMS FOR LOW OBSERVABLE AIRCRAFT**

Military departments desiring to deploy Surface Defect Testing Systems (SDTS) and associated components in a controlled environment for testing of surface defects on low-observable (LO) aircraft shall submit requests for equipment spectrum certification and frequency assignments to the Spectrum Planning Subcommittee (SPS) and FAS, respectively, in accordance with the requirements and procedures established in Chapters 8 and 10 of this Manual.

### 7.26.1 SPS Process

1. The SPS will generally apply the analysis method outlined in Chapter 8 to evaluate the compatibility of the proposed surface defect testing system that fall within the bounds of DSO-CR-13-114 “Assessment of Compatibility between Low Observable (LO) Diagnostic Measurement Systems and Selected Systems” (LO Report)<sup>3</sup>. During the SPS review and preliminary assessment of the system, the coordination trigger-distance tables from the LO Report will be used.

a. If the proposed location and frequency band or bands fall within a coordination trigger-distance, the SPS will request the submitting agency to coordinate with the affected agency or agencies to further assess the potential impact and come up with agreeable interference mitigating techniques or procedures. Techniques might include such actions as reducing power and/or locking out certain frequency bands of concern prior to approving SPS certification. The affected agency or agencies may require the requesting agency to provide more detailed analyses or perform additional measurements. The measurements or analyses may consider additional technical factors of the system and site characteristics. When tests on systems of concern are not feasible, it is possible that a surrogate system may be used.

b. If the proposed location and frequency bands fall outside the coordination trigger-distance, the SPS will certify the equipment without further analyses or measurements.

c. Any additional measurements or analyses used to evaluate or establish compatibility or Trigger Distance table during the SPS review or assessment process will become a resource to be considered for frequency application as well as supporting future spectrum certification requests of new and similar SDTS.

2. If the RF characteristics of an LO system fall outside of the bounds of the characteristics used in the LO Report the submitting agency is required to provide new electromagnetic compatibility reports, coordination trigger-distance tables and/or additional measurements to include supporting test data to the SPS for consideration and approval.

### 7.26.2 FAS Process

The FAS will use the NTIA certification and the referenced SPS assessment to evaluate the frequency assignment applications for SDTS. The agencies will have a final opportunity to refine any mitigation that might be necessary during the FAS review.

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<sup>3</sup> A copy of this report is located at <http://www.ntia.doc.gov/technical-reports>.



## Chapter 8

# Procedures and Principles for the Assignment and Coordination of Frequencies

## 8.1 AUTHORIZING FREQUENCY USAGE

### 8.1.1 General Procedure for Authorizing Frequency Usage

1. Each federal agency decides, in the light of policies, rules, regulations, frequency allocations, and availability of frequencies, whether, what, and how many mission requirements can be fulfilled by using telecommunications systems. Each agency makes the necessary technical studies, selects potential frequencies, coordinates with other agencies involved, and prepares and files an application with the NTIA, Office of Spectrum Management (OSM), Spectrum Services Division (SSD), for consideration by the Frequency Assignment Subcommittee (FAS) of the IRAC.

2. The FCC FAS Representative submits frequency assignment applications for non-federal use of the spectrum in shared bands and other bands where there might be an impact on, or from, federal operations. The FCC, as a government entity, also submits frequency requests to the FAS for FCC spectrum requirements.

3. The OSM processes all applications through a series of automated routines to check them for completeness, accuracy, and compliance with regulations and procedures in so far as possible, then publishes these applications in an agenda for FAS review (FAS Agenda). The FAS agendas are distributed to each FAS member agency for study regarding the protection of their existing assignments. With assistance from the FAS member agencies, the OSM also performs a manual review of these applications to ensure adequate justification, compliance with policy and regulations, technical appropriateness, and whether or not NTIA, with the advice of the Spectrum Planning Subcommittee of the IRAC, has certified spectrum support for the system, if applicable. The OSM also reviews these applications to determine whether or not there is a conflict with the assignments of the FAS non-member agencies. FAS member agencies finding problems with applications listed in the FAS agendas may table these applications for further review, correction, or referral to a formal meeting of the FAS. Tabling action shall be limited to the categories listed previously in this paragraph describing manual review.

4. The FAS considers pending items on a daily basis and takes action within established policy guidelines. Applications are referred to the IRAC when additional policy guidance is needed, agreement cannot be reached, the IRAC has so directed, or an agency so requests. Matters that cannot be resolved with the IRAC, those that NTIA directs, or those requested by an agency, are referred to the Deputy Associate Administrator (DAA), OSM, NTIA, who resolves them or refers them to the NTIA Administrator for a decision. Federal frequency assignment decisions made by the NTIA Administrator may be appealed to the Director of the Office of Management and Budget (OMB) per paragraph 3-2 of Executive Order 12046.

5. Matters of considerable importance, such as changes to the National Tables of Frequency Allocations, significant federal use of non-federal frequency bands, and advice to the Department of State, are recommended to NTIA for consultation with the FCC or other appropriate agencies. Although federal applications are not heard in public for security reasons, the public is represented by the FCC who may object, concur, or give tacit approval.

6. The GMF will be updated weekly to reflect those frequency assignment actions agreed upon by the FAS and approved by the DAA, OSM, NTIA, and, for electromagnetic compatibility analysis purposes, those Canadian assignments along the U.S./Canada border that have been coordinated with the U.S. Government frequency management community under the provisions of the U.S./Canada Coordination Agreement (see Section 3.4).

a. Upon request, the GMF data, including extracts or the entire GMF on CD-ROM, will be distributed by NTIA to federal agencies. However, since the GMF data is classified CONFIDENTIAL, it shall be distributed only in accordance with the provisions of Executive Order 13526.

b. Upon request, NTIA will issue written authorization for those frequency assignment applications which are approved.

c. Requests for distribution of the GMF, extracts thereof, and other listings must be made through the agency's IRAC or FAS representative and directed to:

Chief, Frequency Assignment Branch  
NTIA/OSM/SSD, Room 1982  
U.S. Dept. of Commerce  
1401 Constitution Ave, NW  
Washington, DC 20230

### **8.1.2 Authorizing Frequency Assignments to Stations of Foreign Governments in Washington, DC**

1. Public Law 87-795 amended the Communications Act of 1934 by adding subsection 305(d)<sup>1</sup> which vested in the President the authority to authorize a foreign government to construct and operate a radio station at the seat of government, where (1) he determines that the authorization is in the national interest of the U.S., and (2) where such foreign government has provided reciprocal privileges to the U.S. to construct and operate radio stations within territories subject to its jurisdiction. Under the President's Reorganization Plan No. 1 of 1977, this authority was delegated to the Secretary of Commerce by Executive Order 12046 of March 26, 1978.

2. The Secretary of Commerce has delegated this Presidential authority to the Assistant Secretary of Commerce for Communications and Information (Administrator, NTIA), by Department of Commerce Order 10-10 of May 9, 1978, which states in part, "... Authorization for the construction and operation of a radio station pursuant to this section and the assignment of a frequency for its use shall be made only upon recommendation of the Secretary of State and after consultation with the Attorney General and the Chairperson of the Federal Communications Commission."

3. Following the approval in principle by the Assistant Secretary of Commerce of the establishment of a radio station in Washington, DC, by a particular foreign government, the Department of State will sponsor the necessary frequency applications in the IRAC. IRAC shall review the applications and submit its recommendations to NTIA. The IRAC will be provided with the instruments of authorization as approved by the Deputy Associate Administrator, Office of Spectrum Management, NTIA.

4. The technical conditions and the procedures for IRAC consideration of these applications are as follows:

a. The Department of State representative to the IRAC will submit applications to the IRAC Executive Secretary for technical consideration by the FAS. Such application will indicate that the foreign administration involved has granted privileges to the U.S. for radio stations in the high frequency bands, antenna configuration and location, the hours of operation, and the name of the embassy, which will be included on the form. For radio stations operating as earth stations in the fixed-satellite service (FSS), the data specified in the applicable portion of Appendix 4 of the ITU Radio Regulations (RR) will be included as a minimum. However, when the earth station is proposed to operate in a band which is shared with terrestrial operations, the FAS shall not take action until the IRAC's Spectrum Planning Subcommittee (SPS) has indicated that coordination has been accomplished with the appropriate terrestrial operations.

b. For earth stations operating in a band which is shared with terrestrial operations, the Department of State IRAC representative will submit the data specified in the applicable portions of Appendix 4 of the RR to SPS for coordination with the appropriate terrestrial operations. Additionally, for earth stations in the FSS, the proposed frequency usage shall be coordinated as required by 25.203 of the FCC Rules and Regulations. The results of that coordination together with the data and interference analysis will be included as part of the submission to the SPS.

c. Any embassy obtaining an authorization for an earth station operating in bands allocated for the FSS must designate a representative to act in future coordination matters regarding terrestrial and satellite stations in the Washington, DC area.

d. A call sign or suitable designator will be furnished by the FCC.

e. Frequencies to be authorized shall be limited to those in bands allocated in the U.S. to the fixed service or the FSS, as appropriate.

f. The bandwidth of emission to be authorized will normally be limited to that associated with diplomatic communications.

g. The antenna to be authorized shall be limited to the minimum size and configuration that will support the diplomatic communications system.

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<sup>1</sup> The Communications Act of 1934 was amended in 1996, this text is now contained in subsection 305(c).

h. Applications that clear the FAS shall be referred to the IRAC by the FAS with its recommendations. IRAC shall forward the applications together with its recommendations to NTIA. The Executive Secretary (IRAC) has discretionary power to act for IRAC except in the case of applications for new authorizations.

i. Approved assignments shall be recorded in the GMF of frequency assignments with an indication of (a) the embassy involved; (b) the fact that the assignment was made by the Assistant Secretary under Public Law 87-795; and (c) the fact that the Department of State is responsible for the assignment.

5. The following regulations have been established concerning the operation of these stations:

a. The characteristics of the transmitted signals and the conduct of the operation shall be such as to comply with the provisions of law and treaty that govern operation of other stations under the jurisdiction of the U.S. and with any other provisions that may be prescribed by the President.

b. The operation is subject to adjustment, including termination, in the event of harmful interference to other authorized operations having the right to protection.

c. The station will be operated upon reasonable request by the Department of State for the purpose of conducting brief technical monitoring observations.

d. In general, notification to the ITU of the authorized operation shall be affected by the U.S.

## **8.2 FREQUENCY ASSIGNMENT PRINCIPLES**

### **8.2.1 Frequency Sharing**

Sharing of frequencies is necessary for the fullest utilization of the radio spectrum. This may entail the acceptance of some interference but does not contemplate requiring the acceptance of harmful interference.

### **8.2.2 Planned Frequency Utilization**

1. In the interest of planned and orderly utilization of the radio frequency spectrum, agencies are encouraged to inform the IRAC of planned frequency utilization.

2. This information normally should be furnished to the IRAC as a separate item of business. It may also be furnished to the IRAC or the FAS during the consideration of another agency's frequency assignment application when the proposed assignment has a bearing on the planned frequency utilization.

3. Whether such information will provide any prior rights for the operations concerned shall be determined by specific IRAC or FAS action on a case-by-case basis, taking into account all pertinent factors.

### **8.2.3 Consideration of Applications**

Recognizing that the demand for radio frequencies greatly exceeds the supply, and to make the most efficient and orderly use of available frequencies in the national interest, frequency assignment action is predicated on consideration of all available data, including international regulations, national laws, established government policies, national interest, availability of other possible communication facilities, and technical aspects.

### **8.2.4 Justification for Frequency Assignments**

1. Applications for authority to use radio frequencies must be justifiable for reasons such as:

Specific legislative directive

International commitments

To carry out the established mission of the applicant

2. Applications will indicate the purpose for which the frequency will be used, for example:

Broadcasting

Civil defense

Emergency communications (as when normal communication facilities are disrupted or are inadequate as a result of hurricane, fire, flood, earthquake, or similar disaster affecting safety of life or property)

Environmental data collection and dissemination

Law enforcement

Management and protection of federal property or personnel

National defense

National security  
Protection of national resources (for example, forests and waterways)  
Power transmission and distribution  
Research and experimentation  
Safety  
Space exploration

3. Description of the operation involved, and the specific objective to be satisfied, should be supplied in each instance, in sufficient detail to facilitate consideration of the application.

4. Where the application is for a new assignment, or for the modification of an existing assignment, the justification shall contain information concerning such of the below listed items as are pertinent, together with such other data as may be appropriate to substantiate the application:

a. Name of project; if new, a brief description thereof.

b. If the requested assignment is for use in a new circuit, net or system, or for a significant expansion of an existing system.

c. If it is a replacement frequency.

d. If the frequency applied for is already authorized the applicant, sufficient data concerning the existing authorization(s) to enable an assessment to be made of the expected effect of the requested assignment on the electromagnetic environment.

e. If one or more basic characteristics are unusual for the frequency band or radio service<sup>2</sup> specified, the reason therefore.

f. If the application is for a multiple listing of a particular circuit or operation.

g. The extent to which coordination has been achieved.

5. Applications for authority to use a radio frequency for a service which duplicates adequate existing facilities shall not be approved in other than exceptional cases.

### **8.2.5 Withholding Funds Pending Availability of Frequency Support**

1. The obligation of funds by federal agencies for the development or procurement of communication-electronic equipment, requiring the assignment and protection of radio frequencies for their use, should be withheld pending assurance of the availability of appropriate frequency assignment support. Requirements for obtaining frequency support for telecommunications systems or major modifications of an existing system are under Chapter 10. This includes the selection, procurement, and development of earth or terrestrial station sites and facilities as indicated in Section 8.2.8. This is particularly important in the selection of sites and frequencies for earth and terrestrial stations to be operated in the co-equally shared bands as indicated in Section 8.2.33 (see Sections 8.3.12-8.3.15) and in the bands where there are no federal allocations. In addition, in the case of a federal funded study, or a federal funded equipment procurement, by non-federal interests, wherein the use of radio frequencies is foreseen as a result of the study or procurement, the Federal Government agency concerned should, as far as practicable, apprise the contractor(s)/grantee(s) of the need for ensuring that radio frequency support appears feasible. In this regard, it may be necessary for the federal agency, the non-federal entity, or both, to coordinate with the FCC.

2. This subject is covered in Section 33.4 of OMB Circular No. A-11, as follows: "you must obtain a certification by the National Telecommunications and Information Administration, Department of Commerce that the radio frequency required is available before you submit estimates for the development or procurement of major radio spectrum dependent communications-electronics systems (including all systems employing space satellite techniques)".

3. Before procuring transportable Advanced Wireless Service (AWS), Cellular (Cell), or Personal Communications Service (PCS) systems, including Cell-On-Wheels (COW) and Cell-On-Light-Truck (COLT), operating in the bands 698-758, 775-788, 805-806, 824-849, 869-894, 901-902, 930-931, 940-941, 1710-1755, 1850-1990, and 2110-2155 MHz, federal agencies shall obtain a certification by NTIA.

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<sup>2</sup> Stations operating in a radio service on a secondary basis shall comply with the provisions of this chapter with respect to stations operating in a radio service allocated on a primary basis.

## **8.2.6 Programs to Determine How the Spectrum is Used**

### **Frequency Assignment Review Program**

1. Each federal agency shall maintain a program of continuing review of frequency assignments to its radio stations and shall delete or amend such assignments as appropriate. The objectives of this program are a) to ensure that frequency assignments are in current use and are correctly reflected in the GMF, b) to ensure that frequency assignments are required for continued operations for the purpose stated in their justification, and c) to ensure that frequency assignments are still qualified for authorization under the provisions of the regulations contained in this Manual. Each assignment shall be reviewed in the manner specified in Annex F, unless by the terms of its authorization it is subject to review more frequently.

### **Spectrum Measurement Program**

2. A spectrum measurement program was established in October 1973 under which a van-mounted Radio Spectrum Measurement System (RSMS), operated by the Department of Commerce under the direction of NTIA, is used

a. to determine whether radio installations operated by the Federal Government are utilizing authorized frequencies and are operating in accordance with applicable regulations,

b. to provide information to help determine whether additional uses can be made in a particular band at a particular location, and

c. to provide information to prevent or resolve cases of interference between two or more users.

3. The use of radio frequencies by federal agencies is subject to observation and measurement by the RSMS, in support of the spectrum management activities of NTIA. Notice of this was given to the applicable federal agencies in October 1973. Such agencies should ensure that their field personnel remain informed, as appropriate.

### **Spectrum Management Survey Program**

4. A program to survey spectrum management activities within the Federal Government was established in February 1965. The objectives of this program are to determine at the operational level the degree of implementation of the applicable provisions of this Manual, whether frequency usage is in accordance with authorizations, and to exchange information with a view toward improving spectrum management in general. Surveys are conducted by NTIA personnel by means of on-site observation of communication-electronic facilities and discussions with local frequency managers. Surveys are initiated through coordination with headquarters personnel, who are encouraged to participate in the surveys if possible.

### **Spectrum Resource Assessment Program**

5. NTIA manages a program to assess spectrum use and to identify potential spectrum sharing problems within specific frequency bands allocated to the Federal Government. The objectives of this program include:

a. the review and documentation of the characteristics and deployment of existing and proposed systems in specified bands,

b, the identification of potential band sharing problems which may impact on the efficient use of the spectrum,

c. the evaluation of any identified electromagnetic compatibility problems, and

d. the identification of alternative spectrum management approaches to resolving these problems.

6. The sources of data used in completing these studies include the GMF, system data submitted in accordance with Chapter 10 of this Manual, data collected during the spectrum measurement and survey programs, as well as direct contact with the user agencies. These studies may be used in the development of spectrum policy, as background material for the systems review process (Chapter 10 of this Manual), and are available to the frequency managers of the various federal agencies for planning purposes. Agencies are encouraged to cooperate and participate in the development of these spectrum resource assessments and make use of the spectrum resource assessment assistance which can be provided.

## **8.2.7 Notification of Discontinuance of Service**

Assignment of a frequency to a particular station or class of station imposes upon the assignee the responsibility of duly notifying all interested agencies of proposed discontinuance of a station or a material change in character of service rendered, when other agencies are known to be dependent thereon or materially affected thereby.

## **8.2.8 Stations Located in Close Geographic Proximity**

In general, the inherent right of the station first established is recognized as regards a proposed new station whether transmitting or receiving. Nevertheless, for stations located in close geographic proximity and particularly in the case of installations involving very high effective radiated powers (50 kW or greater), digital system receivers having high carrier to noise ratio requirements or receivers intended for reception of very low level radiation (-100 dBW or less), engineering solutions may require the cooperation of all agencies involved in the application of reasonable and practicable measures within the state of the art to avoid causing or being susceptible to harmful interference.

## **8.2.9 Authorized Area of Operations of Mobile Stations**

For an assignment to a land station and one or more mobile stations, the area described under receiver ANTENNA LOCATION for the reception of transmissions from the land station by the mobile stations shall be considered also as the area in which transmissions from the mobile stations, associated with the land station, are authorized.

## **8.2.10 Relative Priority of Frequency Assignments**

1. Priority, unless specifically qualified, is the right to occupy a specific frequency for authorized uses, free of harmful interference from stations of other agencies.
2. The relative status between radio services and between frequency assignments with respect to their conformity to the Table of Frequency Allocations is indicated in Section 4.1.
3. Unless specifically agreed otherwise at the time a frequency assignment is made, the relative priority between two frequency assignments which are substantially equal is determined by their dates of assignment. The frequency assignment with the earlier date has priority over the frequency assignment with the later date.
4. If a temporary or trial assignment is renewed or converted to a regular assignment, the applicable date of assignment for priority purposes is the original date from which continuous authorization has been in effect. If the particulars of an existing assignment are expanded (e.g., expansion of bandwidth, addition of new receiver antenna location, increase in power), but at a later date the assignment is changed back to the lesser particulars, the applicable date of assignment for priority purposes is the date on which the lesser particulars were first authorized.
5. The priority of a mobile station applies only in the geographical area designated in the particulars of the frequency assignment, as limited by the provisions of any limitation note which is part of the assignment.
6. The priority of a fixed station applies only at the geographical locality of the receiver antenna location designated in the frequency assignment, as limited by the provisions of any limitation note which is part of the assignment.
7. Priority notes shall not be applied to frequency assignments below 25000 kHz. Above 25000 kHz they shall be kept to a minimum.
8. Experimental classes of stations and classes of stations in support of experimental operations are on a secondary basis to stations of all other services.
9. Where, in adjacent regions or sub-regions, a band of frequencies is allocated to different services of the same category (i.e. both primary or both secondary), the basic principle is the equality of right to operate. Accordingly, the stations of each service in one region or sub-region must operate so as not to cause harmful interference to services in other regions or sub-regions.

## **8.2.11 Use of Radio Frequencies Below 30 MHz for Domestic Fixed Service**

1. To insure that, insofar as practicable, sufficient high frequencies will be available for the operation of radio circuits essential to the national security and defense and to conserve frequencies below 30 MHz for services which

cannot be operated adequately without them, only in the following circumstances shall departments and agencies of the Executive Branch of the Government use frequencies below 30 MHz for domestic fixed service<sup>3</sup> (within conterminous United States):

a. When it is indispensable to do so, and on the condition that the characteristics of the stations continue to conform to those in the U.S. list "GMF," a land station may communicate, on a secondary basis, with fixed stations or other land stations in the same category, using its assigned frequencies.

b. Where technical and operational requirements dictate, fixed stations may transmit to other fixed stations for the domestic haul of overseas traffic in transit, or destined for the U.S. Such domestic radio haul shall be a segment of the overall overseas radio system. (These assignments will bear record note S208--see Annex A)

c. When there is a need to provide instantaneous transmission of vital emergency, operational command and alerting traffic of such importance as to affect the immediate survival and defense of the Nation. (These assignments are Category 1 assignments and will bear record note S148--see Annex A)

(1) Circuits in this category will be maintained in operational status at all times, with on-the-air test transmissions to ensure the highest degree of readiness.

(2) Frequency assignments for such circuits shall be afforded protection commensurate with the importance of the communications for which the circuit is intended.

d. When required for use in an emergency jeopardizing life, public safety, or important property under conditions calling for immediate communication where other means of communication do not exist or are temporarily disrupted or inadequate. To ensure that radio equipment for emergency use is maintained in satisfactory operating condition, testing on frequencies in this category is permitted, provided that insofar as practicable transmitters shall be tested with a non-radiating load and the test use of a radiating antenna held to a minimum and provided further that such testing shall be restricted to test message traffic and shall not include operator training. (These assignments are Category 2 assignments and will bear record note L012 or L113--see Annex A)

e. When there is a need to provide for a communications system manned by fully qualified operators who are military reservists or affiliates. Except in emergencies, frequency assignments in this category shall not be used as a means for passing traffic that in the absence of such assignments would require delivery by other means. (These assignments are Category 3 assignments and will bear record note S012--see Annex A)

f. When other telecommunication facilities do not exist, are inadequate, or are impracticable of installation, and when the use of frequencies above 30 MHz is not practicable. (These assignments are Category 4 assignments and will bear record note S206--see Annex A)

g. In an emergency where it has not been feasible to make prior arrangements for alternate means of communications, it is permissible to operate temporarily on regularly assigned frequencies in a manner other than that specified in the terms of an existing assignment or on other appropriate frequencies under the following special circumstances:

(1) An emergency must actually exist or imminently threaten. An emergency for the purpose of this provision means a situation of temporary duration resulting directly or indirectly from a natural catastrophe or other occurrence which seriously affects the welfare of a community or of an area to the extent of endangering human life and property and in connection with which special communications facilities are required temporarily.

(2) Emergency operations shall be discontinued as soon as substantially normal communications facilities are restored.

2. With respect to subparagraphs 1c, 1d, 1e and 1f above, requests for the authorization of frequencies below 30 MHz for new systems, or in circumstances where the pressure on the radio spectrum would be increased materially, shall be referred by the FAS Chairman to NTIA for review prior to assignment action. Approved assignments will be recorded in the GMF, and will bear record note C078 (see Annex A).

a. In compliance with the foregoing, the FAS Chairman shall refer all applications that meet the following conditions:

(1) The frequency is below 30 MHz.

(2) The type of action is NEW, NOTIFICATION or MODIFICATION.

(3) The class of station is FX or AX.

(4) Record note S362 is not applicable.

(5) The transmitter and receiver ANTENNA LOCATIONS (XAL and RAL) are both located within the conterminous U.S.

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<sup>3</sup> Authorization in the fixed service with note S362 are not construed to come within the term "domestic fixed service".

- (6) The proposed frequency usage falls within category 1, 2, 3 or 4 above.
- b. However, referral to NTIA is not required for the following exceptions:
  - (1) EXCEPTION 1--For a change in frequency of an existing station when an existing assignment for a frequency of the same general kilohertz order for that station is simultaneously deleted. (These assignments will bear Record note S358--see Annex A)
  - (2) EXCEPTION 2--For the addition of a new station to an existing domestic fixed circuit or network, provided the addition would not result in an extension of the hours of use of the frequency because of wave propagation. (These assignments will bear Record note S359--see Annex A)
  - (3) EXCEPTION 3--For the modification of an existing assignment, provided the modification would not increase materially the impact on the use of the radio spectrum below 30 MHz. (These assignments will bear Record note S360--see Annex A)
- 3. In order to establish adequate radio backup of wireline facilities in advance for use during an emergency, subparagraphs 1c and 1d above are interpreted to embrace the following elements:
  - a. the predetermination of essential communication circuits which cannot tolerate disruption;
  - b. the installation of the necessary equipment;
  - c. the selection and assignment of frequencies to be employed on those circuits; and
  - d. necessary testing.

## **8.2.12 Explanation of the Term "Tactical and Training"**

1. The descriptive term "tactical and training" has been used for many years in connection with the assignment of radio frequencies and their operational use by units of the U.S. Army (the field Army), Navy (Fleet and Marine Forces), and Air Force (Tactical and Strategic Air Forces).

a. The term "tactical" emphasizes the aspect of mobility and flexibility required by such units as components of a military force whose operations (and tactics) are directed by the responsible military commander. Organizational equipment, including all communications-electronics (C-E) equipment, issued to such military units is designed specifically to meet their peculiar needs under combat conditions. Such C-E equipment includes that required to effect communications internal to the particular unit and its components, as well as communication to the next higher/lower echelon of command and for other special-purpose C-E systems used for surveillance, weapons control, aeronautical and meteorological aids, etc.

b. "Training." In peacetime within the US&P, military operations are normally in connection with training and the obtaining of proficiency in all aspects of their ultimate employment as a military force in an emergency situation. The simulation of wartime operations in day-to-day use, field and fleet exercises and major maneuvers, is an essential requirement to assure immediate operational readiness.

2. The specific frequencies designated and authorized for military tactical and training purposes are primarily utilized as a group to meet the more essential needs, on a day-to-day basis, by operating forces throughout the US&P. Generally, all of these frequencies are assigned for use by major military commands. Where the source of frequencies is inadequate to meet special needs of these commands, e.g., in large exercises and major field and fleet maneuvers, they are supplemented by the use of frequencies in both federal and non-federal bands, subject to established procedures to insure the avoidance of harmful interference to the operations of the primary agencies and activities.

3. In addition to the principal use of such frequencies as set out in the preceding paragraphs, the following uses of a corollary nature, while not necessarily tactical and training, must be recognized where suitable frequencies such as those authorized for tactical and training purposes must be utilized:

a. In event of civil disturbances or other emergencies, military units may be required to assist in maintaining order and in safeguarding human life and property.

b. In the development, type acceptance, and compatibility testing or evaluation of C-E equipment intended for tactical purposes.

c. In effecting training of individuals and units at special service schools and test ranges.

d. In providing demonstrations of military weapons and C-E equipment at laboratories, proving grounds, and test ranges.

4. A further very important aspect which is associated with these tactical and training frequencies, is the fact that this group of frequencies constitutes the limited base to support military needs under initial mobilization conditions. Experience gained from peacetime utilization of the specific frequencies designated and authorized for military tactical and training purposes materially enhances their value and usability in the event of a mobilization situation, particularly during the initial transition phase.



5. Certain military C-E equipment includes both portable and transportable types. In any operational situation it assumes a radio service classification in accordance with the nature of its actual operation. A portable or transportable station may at one moment be operating with a station in the fixed service; alternatively, when communication is involved with an aircraft or a ship, the station may be operating in the aeronautical or maritime mobile service.

### 8.2.13 Guidance on Use of Frequencies by Stations in Certain HF Bands

1. WARC-79 and WARC-92 adopted a number of allocation changes in the 3000-27500 kHz portion of the radio frequency spectrum. The changes reduce the spectrum allocated for the fixed and mobile services and increase the spectrum allocated for HF broadcasting. The effective implementation dates for the expanded radio services will vary over a long period of time; due to the complex reaccommodation process and access restrictions that vary by band. WRC-95 made available for use the HF broadcasting spectrum allocated by WARC-79, effective January 1, 1996. The use of this spectrum is on the basis of Article 12 and taking into account the provisions of No. 5.148.

2. WARC-79 allocated the following HF Bands to the broadcasting service on a primary basis. Exceptionally, fixed service assignments in the bands 9775-9900, 11650-11700, and 11975-12050 kHz, meeting the criteria of RR 5.147, may be retained.

kHz	kHz
9775-9900	15450-15600
11650-11700	17550-17700
11975-12050	21750-21850

3. WARC-92 allocated the following HF bands to the broadcasting service on a primary basis, with an implementation date of 1 April 2007. In these bands, the broadcasting service is limited to single-sideband emissions and characteristics, specified in ITU RR Appendix 11, and subject to planning procedures contained in Article 12:

kHz	kHz
5900-5950	13570-13600
7300-7350	13800-13870
9400-9500	15600-15800
11600-11650	17480-17550
12050-12100	18900-19020

4. After 1 April 2007, continued use of these bands by the fixed and mobile services is internationally governed by the provisions of RR 5.136, 5.143, 5.146 and 5.151 as applicable. Additionally, Resolution 21 provides for implementation of these bands for broadcasting by a future WRC and the reaccommodation of "Class of Operation A" frequency assignments contained in the Master International Frequency Register as of 1 April 1992. Resolution 21 also provides for a transition period from 1 April 1992 to 1 April 2007. Federal agencies should, to the maximum extent feasible, adhere to the following principles when making fixed and mobile service assignments in these bands:

a. Avoid internationally notifying assignments to the fixed and mobile services. If assignments are notified they are subject to review by the BR on 1 April 2007 to determine if they are in conformity with the Table of Frequency Allocations and other provisions of the Radio Regulations.

b. Review assignments of "Class of Operation A" in order to determine if they can be downgraded to "Class of Operation B or C".

c. Identify "Class of Operation A" assignments during the transition period and move them to appropriate frequency bands with notification to the BR. In this regard if only the assigned frequency and no other characteristics of the assignment are changed, the assignment will retain its original date.

d. New frequency assignments that are only required for a short period of time or until 1 April 2007, not requiring international protection, should be made in these bands so that the remaining HF bands allocated to the fixed and mobile services can be used to accommodate "Class of Operation A" assignments.

### 8.2.14 Applications for Frequency Assignments in Bands Allocated to the Radio Astronomy Service

In the bands allocated to the Radio Astronomy Service by the Federal Table of Frequency Allocations, the FAS shall keep the IRAC informed of all applications for assignments that are not in accordance with that Table, including requests for renewals and modifications, except modifications that are of an administrative or non-technical nature.

### **8.2.15 Referral of Applications Related to the Space Service**

In the bands allocated to the space service by the Federal Table of Frequency Allocations, the FAS shall refer to the IRAC all applications for assignments that are:

- a. not in accordance with the Table except when the application is for:
  - (1) the renewal of an existing assignment; or
  - (2) test, and operation of electronic threat simulators during military tactical and training exercises; or
- b. for experimental stations except when the application is for:
  - (1) the renewal of an existing assignment; or
  - (2) the static (ground-to-ground) test of a space system; or
  - (3) experimentation that is consistent with the use for which the band is allocated.

### **8.2.16 Assigning the Most Heavily Occupied Frequency Channel**

In order to have the greatest possible spectrum support for future radiocommunication requirements available, each new frequency assignment should be made in such a way that the increase in the total spectrum space committed is as small as possible. Accordingly, it shall be the normal practice, where feasible and consistent with frequency allocation and assignment plans, to assign the most heavily occupied frequency channel before resorting to those less heavily occupied.

### **8.2.17 Determining Whether a Station is a Federal Station**

1. The following guidelines are to assist in the determination of whether or not a station belongs to and is operated by the U.S. as specified in Section 305(a) of the Communications Act of 1934:

- a. The department or agency concerned should be able to exercise effective control over the radio equipment and its operation; and
- b. The department or agency concerned assumes responsibility for contractor compliance with Executive Branch, departmental, or agency instructions and limitations regarding use of the equipment and ensures that such instructions and limitations are met when operating under the authority of an Executive Branch frequency authorization to the department or agency; and
- c. The station should be operated by an employee of the department or agency or by a person who operates under the control of the department or agency on a contractual or cooperative agreement basis, and who is under supervision of the department or agency sufficient to ensure that Executive Branch, departmental, or agency instructions and limitations are met.

2. It is recognized that a federal agency may make a contract arrangement for maintenance or operation of a radio station under its control without diminishing the effective control of, or responsibility for, such station, provided the appropriate limitations or requirements are specified.

3. Since the foregoing may not cover every case, or where there may be doubt, the determination will be made by the department or agency concerned after consultation with the NTIA/FCC as appropriate.

### **8.2.18 Assignment of a Band of Frequencies to a Station**

When a band of frequencies is assigned to a station, e.g., 400-406 MHz, the necessary bandwidth of the station shall be so located within the band that it does not extend beyond the upper or lower limits of the band.

### **8.2.19 Limitation of Radiated Power**

Federal radio stations shall radiate only as much power as is necessary to ensure a satisfactory service.

### **8.2.20 Reserved**

### **8.2.21 Use of Ionosphere Sounders**

- 1. The use of ionosphere sounders for realtime selection of frequencies for operational communication circuits,

realtime monitoring of upper atmosphere phenomena, and for the predicting of propagation conditions will be authorized only under the following conditions:

- a. When it has been determined that no existing authorized ionosphere sounder transmitter is capable of meeting the requirement under a common user concept.
- b. Operations shall be on a secondary basis to authorized radio services.
- c. Transmissions in the bands 2495-2505, 4995-5005, 9995-10005, 13360-13410, 14990-15010, 19990-20010, 21850-21870, 24990-25010, 25550-25670 kHz and 38.00-38.25 MHz shall be avoided for sounders capable of frequency suppression.
- d. Transmissions shall be swept or stepped through the operating range of the equipment at a rate or time interval expected to avoid harmful interference.
- e. Transmitters shall be designed to eliminate emissions on any frequency channel where harmful interference is caused to authorized radio services.

2. Applications for frequency assignments to sounder network stations or sounder prediction stations shall include the following basic information in the SUPPLEMENTARY DETAILS (SUP) field:

Channeling plan(s) (required for all sounder network stations and, as applicable, for sounder prediction stations)<sup>4</sup>

- Pulse duration(s)
- Pulse repetition frequency(ies)
- Pulse per channel
- Scan rate(s)
- Scan interval(s) (time between scans)
- Antenna type(s)
- Antenna azimuth
- Antenna orientation(s) (If directional, indicate orientation of major lobe.)

3. All applications for sounders shall include a statement that the applicant has determined that no existing authorized ionosphere sounder transmitter is capable of meeting the requirement.

## **8.2.22 Use of Ionosphere Sounders for Purposes Other Than Those Mentioned in Section 8.2.21**

The use of ionosphere sounders for purposes other than those mentioned in Section 8.2.21 shall be authorized only as experimental stations. The conditions to be applied shall be determined on a case-by-case basis.

## **8.2.23 Minimum Data Recommended for Inclusion on Applications for Antenna Testing Assignments Above 30 MHz**

1. The following minimum data are recommended for inclusion, when applicable, on each application for frequency assignment for the testing of antennas above 30 MHz, in order to expedite action on the application and to enable present users of the frequencies to evaluate the potential interference.

- a. Frequency and Transmission Data
  - (1) Frequencies or Frequency Band Required

NOTE--The use of individual frequencies rather than a frequency band will greatly facilitate consideration of the request.

- b. Transmission Characteristics
  - (1) transmitter output power
  - (2) effective radiated power (if ERP is unknown, give a reasonable estimate)
  - (3) types of emission
  - (4) bandwidth for each type of emission
2. Supporting Information
  - a. Name of geographical location and latitude and longitude of antenna site to the nearest second.
  - b. Test Environment
    - (1) profile of terrain-by description, maps and/or other means

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<sup>4</sup> e.g.--First octave: 2.075 to 3.975 MHz, 20 channels spaced 100 kHz.

(2) if tests are to be conducted within shielded enclosures, so state, and give the attenuation (in dB) of the enclosure

c. Antenna Configuration

- (1) type of antenna
- (2) whether full scale or less than full scale
- (3) azimuth of the main lobe
- (4) gain
- (5) beam width in azimuth and elevation
- (6) height above ground
- (7) height above mean sea level

d. Period of Operation

- (1) duration of requirement, including the dates it will be required.
- (2) estimated hours of use, in local time; for example, 0800 to 1700 daily Monday through Friday; daytime only Monday through Friday.

3. Justification

a. Except in very extraordinary circumstances, applications should not be made for bands where regulations prohibit the granting of assignments, for example, the radio astronomy bands, the standard frequency bands, certain space bands. (See U.S. Table of Frequency Allocations.) If an assignment falling in a prohibited band is requested, a complete and adequate justification must be given as to why operation within the prohibited band is required.

b. The service should be specified for which the operational use of the antenna under test is intended, for example, radiolocation, radionavigation, fixed, space.

c. Unusual conditions should be justified, for example, high power for breakdown tests.

d. If the testing is being done under a Federal Government contract, the federal agency and contract number should be specified.

#### **8.2.24 Use of Frequencies in the Bands Between 2850 and 22000 kHz Allocated Exclusively to the Aeronautical Mobile Service**

1. The bands allocated exclusively to the aeronautical mobile service are subdivided into categories defined in Article **43** of the RR as follows:

a. Frequencies in any band allocated to the aeronautical mobile (R) service are reserved for communications related to safety and regularity of flight between any aircraft and those aeronautical stations primarily concerned with flight along national or international civil air routes.

b. Frequencies in any band allocated to the aeronautical mobile (OR) service are reserved for communications between any aircraft and aeronautical stations other than those primarily concerned with flight along national or international civil air routes.

2. National planning for the use of these bands is governed by the provisions of Article **43** and Appendices **20** and **27** of the RR. These appendices allot specific (R) channels for use in particular areas, allot specific (OR) channels for use by particular countries, and set forth technical and operational principles governing this usage. The use of these bands by federal stations is subject to the normal procedures for coordination and assignment, except as provided by Sections 7.5.3 and 7.5.4, and, in addition, such use shall comply with the pertinent international regulations and plans mentioned above and more specifically referenced below.

#### **Aeronautical Mobile (R) Bands**

3. Frequency assignments to stations in the aeronautical mobile (R) service, in the bands allocated exclusively to that service between 2850 and 22000 kHz, shall be assigned in conformity with the provisions and the allotment plan of Appendix **27** to the RR. Such assignments shall conform to the plan for the allotment of frequencies to (a) Major World Air Route Areas (MWARA), (b) Regional and Domestic Air Route Areas (RDARA's), (c) VOLMET Allotment Areas, and (d) Worldwide Allotment Areas contained in Appendix 27 or, to meet operational requirements not otherwise met by the Allotment Plan, comply with the provisions of Appendix **27** for the adaptation of allotment procedures (27/20, 27/21 and 27/22). Assignments in support of International Air Routes (MWARA and VOLMET allotments) are also within the purview of applicable ICAO frequency assignment plans that have been agreed internationally and are recognized in the ITU Radio Regulations.

4. Single sideband operations only are permitted in the bands allocated exclusively to the Aeronautical Mobile

(R) Service in accordance with the provisions of Appendix 27 Part I, Section II, C. This section of Appendix 27 also contains information on the use of several emissions subject to compliance with special provisions applicable to each use.

5. As a matter of general policy, high frequencies are not used for aeronautical mobile (R) communications in the domestic services within the conterminous U.S., the need for such frequencies having been generally eliminated through successful use of VHF communications. However, Appendix 27 Part II, Section I, Article 2 provides for the allotment of frequencies to the RDARAs, which include the conterminous U.S. (RDARA 27/151), and also Alaska (27/143), Hawaii (27/154), Puerto Rico and the Virgin Islands (27/157). This then affords for special and certain related aeronautical communication requirements, not conforming fully to the definition of the Aeronautical Mobile (R) Service, to be satisfied by use of frequencies from these allotments within the limitations of the following national criteria established jointly with the FCC:

a. Communications related to safety and regularity of flight between aircraft and those aeronautical stations primarily concerned with flight along national or international civil air routes shall have absolute priority over all other uses.

b. Use of (R) band high frequencies shall be limited to single sideband air/ground and incidental air/air communications beyond the range of VHF/ UHF facilities.

c. Users shall share to the maximum extent possible.

d. Requirements shall be handled on a case-by-case basis.

e. A showing must be made that the accommodation of the requirements in the bands other than aeronautical mobile (R), e.g., fixed bands, is not satisfactory for technical, operational, or economic reasons.

f. Only those requirements will be considered where the primary need for communications is for the safety of the aircraft and its passengers or for operational control communications, i.e. "communications required for exercising authority over initiation, continuation, diversion, or termination of a flight in accordance with the provisions of Annex 6" (ICAO).

g. Use of aeronautical mobile (R) high frequencies in accordance with the foregoing normally shall be limited to non-military.

h. If the aforementioned criteria are met, the stipulation that (R) bands are to be used only for flights along national and international civil air routes need not be met.

6. The following frequencies are available to all federal users as frequencies that may be used for operational control and safety of civil government aircraft in the specified areas:

Assigned Frequency (kHz)	Carrier Reference Frequency (kHz)	Available Area
2897.4	2896	AK, HI, CONUS
2948.4	2947	AK, HI, CONUS
3002.4	3001	AK, HI, CONUS
6539.4	6538	CONUS Only
8886.4	8885	CONUS Only
8910.4	8909	AK, HI, CONUS
10055.4	10054	HI Only
11307.4	11306	CONUS Only
17950.4	17949	AK, HI, CONUS
21926.4	21925	AK, HI, CONUS
21929.4	21928	AK, HI, CONUS
21935.4	21934	AK, HI, CONUS

7. These frequencies are intended for users in support of operations not exclusively enroute in nature. These frequencies were chosen so as to avoid those channels which might result in harmful interference to aeronautical stations dedicated to the safety and regularity of flight. The use of these channels by U.S. Federal Government stations with a maximum peak envelope power (PEP) of 6 KW for Aeronautical Terrestrial stations and 400 watts for aircraft stations is allowed under Provision 27/60 of Appendix 27 of the RR. (A list of additional frequencies available to designated agencies in specified areas is contained in the IRAC Supplement to this Manual.) It is assumed that the maximum peak envelope power specified above for aeronautical terrestrial stations will produce the mean effective radiated power of 1 KW used as a basis for the interference range contours.

8. Federal aeronautical stations that operate in the aeronautical mobile (R) service within US&P are normally authorized only for the FAA. Non-federal stations in this service are authorized by the FCC. Coordination is accomplished as appropriate for assignments to these stations, and to those fulfilling the joint national criteria, through established IRAC/FCC procedures.

## **Aeronautical Mobile (OR) Bands**

9. Frequencies in bands allocated exclusively to the (OR) service are internationally allocated to countries by Appendix 26 of the RR, which also establishes sharing criteria, protection ratios, and other technical and operational principles. These principles recognize the possible necessity for the adaptation of the allotment plan to meet valid requirements of the various administrations, provided these adaptations do not decrease the protection to frequencies assigned in strict adherence to the plan.

10. Frequencies in the bands allocated exclusively to the (OR) service are nationally used primarily for the satisfaction of military aeronautical requirements. Assignment of frequencies in these bands is subject to coordination with the military departments through the IRAC mechanism.

### **Channels Common to the Aeronautical Mobile (R) and (OR) Services**

11. Section 7.5.3 authorizes aircraft, ships, and survival craft stations to use the channels common to the (R) and (OR) services, carrier (reference) frequencies 3023 and 5680 kHz, provided such use is in accordance with Appendix 13 Part A2, Section I, D, §3 and Appendix 13 Part A2, Section I, F, § 5 of the RR, the appropriate provisions of Appendices 27. Section 7.5.4 authorizes additional uses by mobile stations engaged in coordinated search and rescue operations. Any use of these channels by land stations engaged in the coordination of search and rescue operations shall be in accordance with the same provisions, and shall be authorized by applications submitted and processed through normal assignment procedures.

#### **8.2.25 Use of Frequency Diversity for LOS Transmissions in the Bands Allocated to the Fixed Service Above 1710 MHz**

The necessity for employment of some form of diversity operation on selected LOS fixed radiosystems is recognized when such operation is required to provide acceptable levels of quality and reliability. However, in view of the growing demands on the frequency spectrum and the recognized effectiveness of space diversity techniques, the use of frequency diversity in the bands 1710-1850, 2200-2290, 4400-4990, 7125-7250, 7300-7975, and 8025-8400 MHz is limited as follows:

a. The use of frequency diversity for new federal LOS fixed radio systems shall be limited to those systems for which frequency diversity can be justified. Existing systems employing frequency diversity may continue until such time as frequency assignment congestion dictates the need for reevaluation.

b. The justification for the use of frequency diversity shall include a statement of the requirement for a high degree of systems reliability and another that an engineering evaluation has been made which demonstrates that the required reliability necessitates frequency diversity. The justification shall be submitted in accordance with the provisions of Section 9.8.2, paragraph 80e.

#### **8.2.26 Use of Radio Frequencies to be in Accordance with ITU Provisions**

Except as otherwise provided in this Manual or by the terms of a frequency authorization, present or future, the use of radio frequencies by federal radio stations within the US&P shall be in accordance with the provisions of the ITU Convention and Radio Regulations.

#### **8.2.27 Experimental Use of Certain Radio Spectrum**

Experimental use of any shared federal/non-federal frequency band or exclusive federal frequency band may be authorized so that non-federal developers may advance the state of technology. Experimental usage will be authorized for the period required subject to not exceeding five years, which may be extended with appropriate justification. However, in order to protect operations on frequencies assigned or required for operation of the National Airspace System, the frequency bands under the Aeronautical Assignments Group area of responsibility as defined in Section 1.3.2, and those bands designated in Section 8.3.16, will normally be authorized for a period not to exceed two years. Any use of these bands for experimental use beyond two years may be authorized on a case-by-case basis with appropriate justification.

## 8.2.28 Radio Frequency Electromagnetic Field Safety and Protection

1. Exposure to radio frequency (RF) electromagnetic fields may present potential health hazards. Federal agencies shall take actions consistent with existing safety and health standards/guidelines, applicable voluntary national standards/guidelines, and prescribed federal regulations to ensure that people are protected from such emissions.

2. Federal agencies shall implement an RF safety program to protect exposed persons. RF safety programs may be individualized by agency and may be a part of an overall general safety program. Agencies may adopt recognized emission exposure standards/guidelines or portions of recognized standards/guidelines to develop an RF safety program most suitable for their facilities. Agencies should ensure that the most current versions of their chosen standard/guideline are used.

3. RF emitters licensed by the FCC but located on federal property must comply with the FCC's existing safety and health standards/guidelines, applicable voluntary national standards/guidelines, and prescribed federal regulations. NTIA-authorized emitters on non-federal property must comply with existing safety and health standards/guidelines, applicable voluntary national standards/guidelines, and prescribed federal regulations used by the federal agency operating the emitter.

4. All RF emitters at or near a specific location must be taken into consideration in a complete RF safety evaluation. Agencies shall use the most current methodologies for the calculations and/or measurements to ensure compliance with existing safety and health standards/guidelines, applicable voluntary national standards/guidelines, and prescribed federal regulations.

## 8.2.29 Use of Frequencies by Stations in the Maritime Mobile Service

1. Stations in the maritime mobile service utilize bands allocated either exclusively to this service or on a shared basis with other services. Several international plans detail the specific uses of certain frequencies. The maritime mobile service is provided with detailed operational and frequency regulations contained in the ITU Radio Regulations. In addition, an abstracted manual which includes pertinent ITU Radio and Telegraph and Telephone Regulations entitled "Manual for Use by the Maritime Mobile Service," is issued by the ITU, and shall be carried by federal ships as required by and in accordance with regulations of the user agency (Appendix 16).<sup>5</sup>

2. National planning for the use of the maritime mobile bands closely follows the international use.

### Maritime Mobile Telegraphy

3. Ship stations use working frequencies in the bands 415-490 kHz and 510-535 kHz, specified by No. **52.39**, for transmissions to coast stations. Coast stations transmit on other frequencies in these bands. Initial contact is usually established by calling on 500 kHz and shifting to appropriate working frequencies. Special provisions for Morse telegraphy calling allow the use of 512 kHz when 500 kHz is being used for distress (No. **52.41-52.44**). All ship stations equipped with NBDP to work in these bands shall be able to receive class F1B emissions on 518 kHz, if complying with the provisions of RR Chapter VII (GMDSS). (See No. **51.45** and **52.97**).

4. Frequencies in the bands between 4 and 27.5 MHz, allocated exclusively for this service, are used for several telegraphy modes. The frequency sub-bands available for assignment for each mode to coast and ship stations shall be as specified in No. **52.12**, **52.13**, and Appendix 17.

5. Several limitations apply to use of frequencies in the exclusive maritime mobile bands between 4 and 27.5 MHz:

a. Power limits for coast stations are:

(1) Single Channel A1A or F1B emissions (No. **52.56** and **52.104**):

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<sup>5</sup> References in this section to appendixes and footnotes listed as No. ### refer to ITU Radio Regulations.

Maximum Power (kW)		
Band (MHz)	A1A (pX)	F1B (pY)
4	10	5
6	10	5
8	20	10
12	30	15
16	30	15
18	No A1A	15
22	30	15
25	No A1A	15

(2) Multichannel telegraphy (No. **52.172**):

2.5 kW (mean) per 500 Hz bandwidth

(3) For digital selective calling and acknowledgement, and for types of transmissions other than those indicated in (1) or (2) above, the maximum mean power shall not exceed the power specified for F1B emission in (1) above.

b. Power limits for ship stations:

Except for transmissions, in the exclusive maritime mobile bands between 4 and 27.5 MHz, of digital selective calls and acknowledgements, which are limited to a mean power of 1.5 kW, international radio regulations have no power limit for ship stations (MS) operating in the radiotelegraphy mode. The power used should be the minimum power, consistent with transmitter capability, necessary to provide satisfactory communications.

c. Appendix **17** provides for ship and coast use in several functional allocations:

(1) Wideband telegraphy, facsimile and special transmission systems--Assignments to ship stations using wideband telegraphy, facsimile and special transmission systems may be adjusted to meet needs of systems using these bands provided they remain within the band limits (No. **52.170**). The shared use of certain ship station frequencies between federal and non-federal shall be in accordance with US296.

(2) A1A Morse calling--See Appendix **17** for frequencies available.

(3) Oceanographic data transmission--Use of these frequencies is limited to the transmission of oceanographic and meteorological data from ships and buoys. Oceanographic data interrogating stations may use these frequencies for interrogation of ships and buoys. The power of ship stations used for oceanographic data transmission (Station Class OD), including buoys or other sensor platforms, is limited to 100 watts. See Appendix **17** for frequencies available.

(4) Narrowband direct-printing telegraph and data transmission systems--See Appendix **17** for frequencies available.

(a) Narrowband direct-printing telegraph--International technical standards for narrowband direct printing telegraphy systems are contained in ITU-R M.476-5 and shall be used nationally.

(b) Data transmission systems--Standards for data transmission systems have not been established by the ITU.

(5) A1A Morse working--See Appendix **17** for frequencies available.

(6) Digital selective calling--See Appendix **17** for frequencies available.

## Maritime Mobile Radiotelephony

6. Bands available to the maritime mobile service for radiotelephony are divided generally into exclusive maritime bands and bands shared with other services. The class of emission authorized in each band is described below. Where single sideband is specified, the authorized bandwidth is 2.8 kHz, upper sideband mode only is permitted, the assigned frequency must be 1.4 kHz above the carrier, and technical standards of ITU-R M.1173 shall be followed. Where FM is specified, technical standards of ITU-R M489-2 shall be followed. The principal bands within which maritime mobile radiotelephony may be authorized are:

a. 1605-3500 kHz--Portions of these bands are allocated to the Maritime Mobile Service exclusively, while other portions are shared with the fixed, mobile, and other services. Class J3E emission only may be authorized for U.S. ship and coast stations.

(1) Coast stations shall be limited to 5 kW (PEP) when located north of 32°N and 10 kW (PEP) when located south of 32°N.

(2) The use of J3E emission in U.S. waters is mandatory on carrier frequency 2182 kHz; however, H3E emission is also authorized for communications with foreign ship and coast stations (Appendix **13**, Part A2, Section



I, C'2). Class A3E emission on this frequency is no longer authorized except for such apparatus (at ship stations) provided solely for distress, urgency and safety purposes (51.53).

(3) Digital selective calling for distress and safety purposes shall be conducted on the frequency 2187.5 kHz. Digital selective calling for other than distress and safety purposes may be conducted on 2189.5 kHz (ship-to-shore) and 2177 kHz (ship-to-ship and shore-to-ship).

(4) Provisions for the use of the single sideband radiotelephone channels within the band 2170-2173.5 kHz and 2190.5-2194 kHz are:

(a) The assignable frequencies are 2171.9 and 2192.4 kHz.

(b) Emission is limited to J3E.

(c) Power is limited to 400 watts PEP.

b. 4.0-23.0 MHz--Nationally and internationally only single sideband class J3E emission may be authorized. The PEP of ship stations shall not exceed 1.5 kW. The PEP of coast stations shall not exceed 10 kW. Within these limitations, frequencies in certain cases, are available to the maritime mobile service in exclusive bands for duplex and simplex use as set forth below:

(1) Duplex--Both ship station and coast station single sideband frequencies are designated in Appendix 17, Annex 1, Part A, Section I, Subsection A, on a paired basis. In addition, Appendix 25 provides an international frequency allotment plan by areas for use of those frequencies designated in Appendix 17, Annex 1, Part A, Section I, Subsection A. In general, while ships normally do not transmit on coast station frequencies in certain cases, federal ship stations are authorized to do so by Section 7.5.5. International notification of allocated channels are made in accordance with the provisions of ITU Appendix 25 and Article 17. National requirements developed in IRAC Documents 18380 and 25934 provided the basis for such notifications.

(2) Simplex--The frequencies of Appendix 17, Annex 1, Part B, Section I, Sub-section B may be authorized for use on a simplex basis by coast and ship stations. Additionally, the assigned frequencies 4126.4, 4418.4 and 6517.4 kHz also may be so authorized. The use of 6517.4 kHz for this purpose should be limited to day-time operation. Simplex frequencies may be authorized for both ship/coast stations and intership communications. Intership operations may be on two frequencies if they are cross banded. Power for these simplex frequencies shall not exceed 1 kW peak, and emission is limited to class J3E. These frequencies are shared equally on a non-priority basis by both federal and non-federal coast and ship stations in a manner consistent with the provisions of US82.

c. 156-162 MHz--Within these limits, the band is divided into numbered channels which are listed in Appendix 18, along with recommended use. Assignments not in accordance with Appendix 18 are subject to adjustment to other frequencies in this band as long-term U.S. maritime VHF planning develops.

(1) The band 157.0375-157.1875 MHz is allocated to the federal for maritime mobile operations. The band is divided into six channels. Two of these channels have a specialized use associated with non-federal maritime mobile operations. Channel 22, 157.1 MHz, is the primary frequency for federal and non-federal liaison communications with the U.S. Coast Guard. Channel 81, 157.075 MHz, is primarily for environmental protection operations as outlined in Section 7.5.6.

(2) The remainder of the VHF channels in the band 156-162 MHz are allocated to non-federal use; however, channels are available to the Federal Government as outlined below:

(a) Channels 12 and 14, 156.6, 156.7 MHz, and the Channel 20 duplex pair, 157.0 and 161.6 MHz, may be authorized for port operations. Record note L283 applies for coast stations.

(b) Channel 6, 156.3 MHz, may be authorized for intership operations. It is already authorized for coordinated operations at the scene of a SAR incident as outlined in Section 7.5.4. Record Note S063 applies. Coast stations may use 156.3 MHz for exchange of traffic dealing with safety of life or property when other means of communication are not practicable. Record Note L330 applies.

(c) Channels 12, 14, 11 and 13, 156.6, 156.7, 156.55 and 156.65 MHz in priority order, may after coordination with the FCC, and be authorized for Vessel Traffic System (VTS) operation.

(d) Channel 13, 156.65 MHz, may be authorized for bridge-to-bridge operations according to provisions set forth hereafter.

(e) Channel 16, 156.8 MHz, is designated nationally and internationally for distress, safety and calling. Federal ship and coast stations, during their hours of service of VHF radiotelephony, shall maintain a watch for reception of 156.8 MHz whenever practicable. Federal ships transiting portions of the St. Lawrence Seaway or a U.S. Coast Guard operated VTS may terminate the listening watch on 156.8 MHz when directed by the Seaway or VTS authorities to call and work on a designated ship movement frequency. Assignments on 156.8 MHz shall include Record Note S035.

(f) For public correspondence purposes ship stations are authorized to communicate with public

correspondence coast stations. In these instances, the ship station shall transmit on the designated ship frequency appropriate to the public correspondence channel assigned to the coast station. Assignments for such use shall include Record Note L197. The specific receiving coast station shall be listed in Receiver Antenna Location field; however, if there are more than three receiver locations, list the area in which the receiving stations are located.

(g) Other authorized use of frequencies by mobile stations to communicate with non-government stations is contained in Section 7.5.2. Record Note S165 applies.

(3) Port operations channels may be used in lock and waterway operations in addition to operations at or near ports.

(4) Stations on board aircraft may communicate with stations of the maritime mobile service. The communications of an aircraft station shall be brief and limited to operations in which maritime mobile stations are primarily involved, and where direct communications between aircraft and the ship or coast station is required.

(a) The mean power of aircraft stations shall not exceed 5 watts, however, a power of 1 watt or less shall be used to the maximum extent possible.

(b) While using the frequency band the altitude of aircraft stations should not exceed 305 meters (1,000 feet) except for reconnaissance aircraft participating in ice-breaking operations where an altitude of 457 meters (1,500 feet) is allowed. The frequencies 156.3 and 156.8 MHz may be used by aircraft stations for safety purposes only.

(5) Stations operating in the maritime mobile service in the band 156-162 MHz are subject to the technical standards and power limitations of Sections 5.3.2 and 5.2.1.

(6) Stations on board federal vehicles used for towing trailered boats engaged in SAR operations, or SAR training exercises, are authorized to operate on VHF FM maritime mobile frequencies with stations in the maritime mobile service. Such stations are subject to the technical standards and power limitations applicable to the maritime mobile service.

### **Bridge-to-Bridge Communications and Navigational Communications on 156.65 MHz or 156.375 MHz**

7. General. Public Law 92-63 (33 USCA, Sections 1201-1208), the Vessel Bridge-to-Bridge Radiotelephone Act, provides the statutory basis for the national designation of "a specific frequency or frequencies dedicated to the exchange of navigational information on navigable waters of the United States".

a. The primary purpose of the act, and for the designation of a navigational communications frequency pursuant thereto, is to "provide a positive means whereby the operators of approaching vessels can communicate their intentions to one another through voice radio." Thus, the primary use of the designated navigational communications frequency provided for by the act is ship-to-ship. However, it is clear from the act's regulatory history that limited use of this frequency by certain shore stations would be "clearly in the interest of navigational safety" and, therefore, permissible.<sup>6</sup>

b. The act applies to both U.S. Government vessels and non-federal vessels and, for obvious reasons, effective implementation requires that all vessels subject to its provisions operate under compatible requirements. The FCC has promulgated, in Part 80 of its rules, regulations governing non-federal vessels subject to the act. The regulations herein, effective for all U.S. Government vessels subject to the Act, are fully compatible with the FCC regulations.<sup>7</sup>

c. The Navigational Communications Frequencies. Pursuant to Section 2 of the aforementioned Act, and except for a limited area of the Southern Louisiana section of the Mississippi River System, the frequency 156.65 MHz, 16K0F3E emission, has been designated as the national "navigational communications frequency." The frequency 156.375 MHz has been designated as the "navigational communications frequency" in the lower Mississippi River. For the purpose of these regulations "navigational communications" are those communications between ship stations, or between coast stations and ship stations, in which messages are restricted to those relating to the maneuvering and the safety of ships and, in emergency, to the safety of persons.

d. Use of 156.65 or 156.375 MHz for navigational communications. The frequency 156.65 or 156.375 MHz, 16K0F3E emission, is available for assignment to:

(1) Bridge-to-bridge stations aboard federal vessels subject to the provisions of the Vessel Bridge-to-Bridge

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<sup>6</sup> Hearing before Merchant Marine Subcommittee, Committee on Commerce, U.S. Senate, Serial No. 91-98, p. 29.

<sup>7</sup> For vessels navigating on those waters governed by navigation rules for the Great Lakes and their connecting and tributary waters, see the following sub-section entitled "Bridge-to-Bridge" Communications for Vessels Navigating on the Great Lakes.

Radiotelephone Act for use in conformity with the purpose of the Act and the definition of such stations in Section 6.1.3 of this Manual,<sup>8</sup> and

(2) Federal coast stations for navigational communications with vessels.

e. Use of the frequency 156.65 or 156.375 MHz by any federal station shall be limited exclusively to navigational communications as defined herein or for necessary tests.

f. Since the navigational communication frequency necessarily will be shared by a large number of users, and in recognition of the safety of life aspect inherent in the operations involved, it is essential that the communication range of all stations using this frequency be restricted. Unless specifically authorized otherwise, a mean power not to exceed 1 watt shall normally be used. A maximum power of 25 watts for vessels and 10 watts for shore stations may be used in exceptional cases when communications cannot be established using one watt. Antenna height and gain limitations are under consideration; in the interim, heights should be limited to the minimum required for reliable communications over the distance involved.

g. Transmissions on the frequency 156.65 or 156.375 MHz shall be identified by the name of the vessel, or the facility in the case of a coast station, in lieu of a call sign.

h. All federal use of 156.65 or 156.375 MHz is subject to the technical standards in Chapter 5 of this Manual. Vessel bridge-to-bridge radiotelephone installations are, additionally, subject to the requirements of the following paragraphs.

i. Vessel Bridge-to-Bridge Radiotelephone Installation. Section 2 of the Act states that the purpose is "to provide a positive means whereby the operators of approaching vessels can communicate their intentions to one another through voice radio...." Thus, the Act clearly imposes a total system communications requirement which, necessarily, involves both transmitting and receiving capabilities, on all vessels subject to the Act.

j. It is considered that the basic operational objectives of the Act will be met by transmitting and receiving installations having the following minimum performance characteristics:

(1) Vessel transmitters--For navigational communications, transmitters should be capable of effective transmission of 16K0F3E emissions with at least 8 watts mean power into 50 ohms effective resistance in the case of non-portable transmitters and at least 0.75 watt in the case of portable transmitters. Each non-portable transmitter, and each portable transmitter of more than one watt, shall have provisions for readily reducing the power to a value not less than 0.75 watt and not more than 1 watt. After January 21, 1997, non-portable transmitters must automatically reduce the carrier power to 1 watt or less when tuned to the frequency 156.375 MHz or 156.650 MHz. A manual override device must be provided which when held by the operator will permit full carrier power operation on these channels. Transmitters should be adjusted so that the transmission of speech normally produces peak modulation within the limits 75-100%. (Note: Other applicable standards are in Chapter 5.)

(2) Vessel receivers--Receivers should be capable of effective reception of 16K0F3E emission on navigational communication frequencies and should comply with the following characteristics:

(a) Frequency stability within 0.001%.

(b) Usable sensitivity of 0.5 microvolt, maximum, for nonportable receivers and 1.0 microvolt, maximum, for portable receivers.

(c) Adjacent channel selectivity and desensitization of 70 dB, minimum, for non-portable receivers and 40 dB, minimum, for portable receivers.

(d) Modulation acceptance bandwidth of 7 kHz, minimum.

(e) Spurious response attenuation of 85 dB, minimum, for nonportable receivers and 50 dB, minimum, for portable receivers.

(3) Vessel Antenna--Antennas should be as non directional (horizontally) and as efficient as is practicable for the reception of ground waves at 156.65 MHz.

(4) Channel 22A Requirement--The radiotelephone installation required by this section must also be capable of transmitting and receiving on channel 22A (157.1 MHz).

(5) Channel 67 Requirement--While transiting any of the following waters, vessels subject to the Act also must have on board a radiotelephone capable of transmitting and receiving on channel 67 (156.375 MHz):

(a) The lower Mississippi River from the territorial sea boundary, and within either the Southwest Pass safety fairway or the South Pass safety fairway specified in 33 CFT 166.200, to mile 242.4 AHP (Above Head of Passes) near Baton Rouge,

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<sup>8</sup> Where the Act describes vessels in "gross tons," a useful conversion is: Each 100 cubic feet of enclosed space is equivalent to 1 gross ton.

(b) The Mississippi River-Gulf Outlet from the territorial sea boundary, and with the Mississippi River-Gulf Outlet safety fairway specified in 33 CFR 166.200, to that channel's junction with the Inner Harbor Navigation Canal; and,

(c) The full length of the Inner Harbor Navigation Canal from its junction with the Mississippi River to that canal's entry to Lake Pontchartrain at the New Seabrook vehicular bridge.

k. For operating regulations, maintenance requirements, and limitations on use of the bridge-to-bridge radiotelephone installation, see Title 33 CFR, Chapter 1, Part 26.

l. Exemptions of Vessels from Requirements of the Act. Applications for the exemption of vessels from the provisions of the Vessel Bridge-to-Bridge Radiotelephone Act should be forwarded directly to the Commandant, U.S. Coast Guard.

## **Bridge-to-Bridge Communications for Vessels Navigating On The Great Lakes**

8. **General.** Each federal vessel navigating on the waters under the navigational rules for the Great Lakes and their connecting and tributary waters and to which the Vessel Bridge-to-Bridge Radiotelephone Act (33 USCA, Sections 1201-1208) applies, is exempt from the regulations of the act under Sections 26.03, 26.04, 26.05, 26.06, and 26.07 of Title 33, Code of Federal Regulations (CFR), Part 26. These exempted sections comprise those regulations pertaining to the type of radiotelephone required; the use of the designated frequency 156.65 MHz; the use, maintenance, and failure of the radiotelephone; and the use of the English language. Sections 26.01, 26.02, 26.08, 26.09 (a), and 26.10 of Title 33 CFR remain in effect. These sections deal with the purpose of the act, definitions, exemption procedures, and penalties.

9. Each of these vessels must comply with the appropriate provisions of "The Agreement between the United States and Canada for Promotion of Safety on the Great Lakes by means of Radio, 1973", outlined in the following paragraphs, that provide for a bridge-to-bridge communications capability considered to be in constructive compliance with the Vessel Bridge-to-Bridge Radiotelephone Act.<sup>9</sup>

10. Radiotelephone Installation. Each federal vessel shall be fitted with radiotelephone installations that are capable of effectively transmitting and receiving G3E emissions on at least the following VHF channels:

Channel 16--156.8 MHz (Distress, safety and calling)

Channel 6--156.3 MHz (Primary intership)

Channel 13--156.65 MHz (Navigational bridge-to-bridge)

Channel 12--156.6 MHz

Channel 14--156.7 MHz

a. Additionally, such other frequencies as required for the vessel's service and to include the capability to receive VHF-FM marine navigation warnings for the area of operation.

b. The radiotelephone station, exclusive of the antennas and source of electric energy, shall be located as high as practicable on the vessel, preferably on the bridge.

c. The principal operating position of the radiotelephone installation shall be on the bridge, convenient to the conning position.

d. Where the radiotelephone station is located elsewhere than on the bridge, provision shall be made for complete operational control of the equipment at that location and at the bridge operating position. However, provision shall be made to take immediate and complete control of the equipment at the bridge operating position.

e. Provision shall be made for illuminating the operating controls at the principal operating position.

f. Means shall be provided for charging any storage battery used in connection with the radiotelephone station.

g. The radiotelephone transmitter shall be capable of delivering at least 10 watts carrier power to the antenna. Provision shall be made to reduce this power readily to 1 watt.

h. The radiotelephone receiver shall have a sensitivity of at least 2 microvolts across 50 ohm or equivalent input terminals, for a 20 decibel signal-to-noise ratio.

i. The associated antennas shall be effective, vertically polarized, and located as high as practicable on the masts or superstructure of the vessel. The transmission line shall be effective and, to the extent practicable, shall impose a minimum loss.

j. The radiotelephone installation is subject to the technical standards in Chapter 5 of this Manual.

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<sup>9</sup> Reference 40 Federal Register 87 (May 5, 1975).

11. Vessel Bridge-to-Bridge Watch. Each federal vessel shall, when underway, maintain a continuous and effective watch on channel 13 (156.65 MHz). Vessels are exempt from this requirement while transiting the St. Lawrence Seaway and complying with the Joint Regulations of the St. Lawrence Seaway Authority and the Saint Lawrence Seaway Development Corporation between the lower exit of St. Lambert Lock at Montreal and Crossover Island, New York, and in the Welland Canal and approaches between calling-in points No. 15 and No. 16.

- a. Sequential monitoring techniques alone are not sufficient to meet this requirement.
- b. Portable VHF equipment may be used to meet this requirement.
- c. This watch shall be maintained by the master, or person designated by the master, who may perform other duties provided they do not interfere with the effectiveness of the watch.

12. The UHF frequencies and technical standards for on-board communication stations as provided by No. **5.287**, **5.288** and ITU-R M.1174, respectively are:

- a. The preferred two simplex (duplex) frequencies for use in the territorial waters of the U.S. for on-board communications are paired as follows:

On-Board Communications	
On-Board Repeater (Transmit) (MHz)	On-Board Mobile (Transmit) (MHz)
457.525	467.750
457.550	467.775
457.575	467.800
457.600	467.825

Use of these frequencies by government stations is subject to agreement with the FCC in the IRAC/FCC mechanism.

- b. Technical characteristics:

(1) Effective radiated power not to exceed 2 watts. Whenever practicable the equipment should include a device to readily reduce the power by at least 10 dB.

(2) In the case of equipment installed at a fixed point on the ship, the height of antenna shall not be more than 3.5 meters (approximately 10 feet) above the highest working deck.

(3) Only FM with a pre-emphasis of 6 dB/octave (phase modulation) shall be used.

(4) Deviation not to exceed 5 kHz.

(5) Tolerance shall be 5 parts in 106.

(6) The audio-frequency band shall be limited to 3000 Hz.

### 8.2.30 Procedure in a Case of Harmful Interference

1. When harmful interference is received to federal operations within the U.S., the following actions should be taken in the absence of agency instructions to the contrary:

- a. Agency personnel should determine the source, if possible. If the source can be identified, agency personnel should try to eliminate the harmful interference by working directly with individuals located at the source.

- b. If agency personnel determine that the source of the interference is a non-federal system or are unable to determine the source using only their agency's resources and they suspect that the source of the interference may be a non-federal user, agency personnel should notify the agency's Spectrum Management Office (SMO) and request support from the FCC through the Public Safety Interference Portal at [https://fccprod.servicenowservices.com/psix-esix?id=psix\\_form](https://fccprod.servicenowservices.com/psix-esix?id=psix_form) or by contacting the FCC's Operations Center at 202-418-1122 or [FCCOPS@fcc.gov](mailto:FCCOPS@fcc.gov). The Operations Center is staffed 24/7.

- c. If the source of the interference is a federal system and the interference cannot be resolved satisfactorily at the agency level, the agency's SMO may refer the matter to the IRAC for assistance.

2. In reporting interference in any of the above cases, use the NTIA Interference Report Form, which can be downloaded at

[https://www.ntia.doc.gov/files/ntia/publications/section\\_8.2.30\\_form\\_for\\_interference\\_reporting.pdf](https://www.ntia.doc.gov/files/ntia/publications/section_8.2.30_form_for_interference_reporting.pdf).

Please submit a copy of the report to [InterferenceReport@ntia.gov](mailto:InterferenceReport@ntia.gov).

3. In case of interference near the Canadian or Mexican borders, also use the procedures in the NTIA Manual

Sections 3.6 and 3.9.12, respectively.

4. In case of interference to federal operations outside the U.S. (where NTIA and the FCC do not have jurisdiction), please refer the matter to the agency's SMO.
5. For information on contacting your agency's SMO, contact the Chief of the Frequency Assignment Branch at 202-482-4483.

### **8.2.31 Conversion of Stations in the Aeronautical Mobile Service to Single Sideband or Independent Sideband Transmission**

In the bands below 30 MHz, equipment procured for the aeronautical mobile service shall be capable of single sideband (SSB) or independent sideband (ISB) emission with suppressed or reduced carrier. In the case of stations in the aeronautical mobile (R) service, the use of SSB shall be determined by the international requirements pertaining to that service.

### **8.2.32 Control of Emissions from Space Stations**

The use of frequencies by space stations will be authorized only in those cases where such stations are equipped so as to ensure the ability to turn on or to provide immediate cessation of emissions by telecommand.

### **8.2.33 Selection of Sites and Frequencies for Earth and Terrestrial Stations in the Bands Above 1 GHz Shared with Equal Rights by Terrestrial Radiocommunication and Space Radiocommunication Services**

Sites and frequencies for terrestrial stations and earth stations, operating in frequency bands shared with equal rights between terrestrial radiocommunication and space radiocommunication services, shall be selected having regard to the relevant ITU-R Recommendations with respect to geographical separation between earth stations and terrestrial stations.

### **8.2.34 Power and Direction of Maximum Radiation of Stations in the Fixed or Mobile Service in Certain Bands Shared with Stations in the Space Radiocommunication Services (Earth-to-Space) on an Equal Rights Basis**

1. As far as practicable, sites for transmitting stations, in the fixed or mobile service, employing maximum values of equivalent isotropically radiated power (e.i.r.p.) exceeding the values given in Table 8.2.34-1 in the frequency bands indicated, should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit (GSO) by at least the angle in degrees shown in the Table, taking into account the effect of atmospheric refraction. Information on this subject is given in the most recent version of Recommendation ITU-R SF.765.

2. For their own protection receiving stations in the fixed or mobile service operating in bands shared with space radiocommunication services (space-to-Earth) should also avoid directing their antennas toward the GSO if their sensitivity is sufficiently high that interference from space station transmissions may be significant.

3. For frequency bands above 15 GHz (except 25.25-27.5 GHz), there is no restriction on the angular separation for transmitting stations of the fixed or mobile service. This matter is being studied, e.g., in the ITU-R.

**Table: 8.2.34-1**

Frequency Band (GHz)	E.i.r.p. Value (dBW) (See also Paragraphs 1 and 5)	Minimum Separation Angle with Respect to Geostationary-Satellite Orbit (Degrees)
1 - 10	+35	2
10 - 15	+45	1.5
25.25 - 27.5	+24 (in any 1 MHz band)	1.5
Other bands above 15GHz	+55	No limit

4. The maximum e.i.r.p. of a station in the fixed or mobile service shall not exceed the values contained in Section 5.3.3.2 (*Maximum Equivalent Isotropic Radiated Power (EIRP) Table*).

5. Where compliance with paragraph 1 for frequency bands between 1 GHz and 10 GHz is impracticable, the maximum e.i.r.p. of a station in the fixed or mobile service shall not exceed:
- +47 dBW in any direction within  $0.5^\circ$  of the GSO; or
  - +47 dBW to +55 dBW, on a linear decibel scale (8 dB per degree), in any direction between  $0.5^\circ$  and  $1.5^\circ$  of the GSO, taking into account the effect of atmospheric refraction.
6. The power delivered by a transmitter to the antenna of a station in the fixed or mobile service shall not exceed +13 dBW in frequency bands between 1 GHz and 10 GHz or +10 dBW in frequency bands above 10 GHz.
7. The limits given in paragraphs 1, 5, 6, and 7 apply, where applicable, to the services and frequency bands indicated in Table 8.2.34-2 for reception by space stations where the frequency bands are shared with equal rights with the fixed or mobile service:

**Table: 8.2.34-2**

Frequency Band	Service	Limit as specified in paragraphs
2200-2290 MHz 7900-8025 MHz 8025-8400 MHz	Fixed-Satellite Meteorological-Satellite Space Research Space Operation Earth Exploration-Satellite Mobile-Satellite	1, 4, 5, and 6
14.4-14.5 GHz 14.5-14.7145 GHz 14.7145-14.8 GHz	Fixed-Satellite	1, 4, and 6
25.25-27.5 GHz	Inter-Satellite	1, 4, and 6

8. Trans-horizon systems in the 1700-1710 MHz band may exceed the limits given in paragraphs 4 and 6, but the provisions of paragraphs 1 and 5 should be observed. Considering the difficult sharing conditions with other services, the number of trans-horizon systems in these bands should be kept to a minimum.
9. A computer program is available in the NTIA for checking compliance of fixed stations with the foregoing provisions. One version of this program is used in checking frequency assignment applications. A separate version is used in support of the SPS in the system review process (see Chapter 10) and will be used by the NTIA upon request from agencies not having direct access to the NTIA computer. To provide more general assistance to agencies in the earlier stages of planning of fixed and mobile systems for operation in these bands, a table is provided in Annex B which identifies transmitter pointing angles that should be avoided under certain postulated conditions.

### **8.2.35 Power and Direction of Maximum Radiation of Earth Stations in Certain Bands Shared with Stations in the Fixed or Mobile Service**

1. The e.i.r.p. transmitted in any direction towards the horizon by an earth station shall not exceed the following limits except as provided in paragraphs 3 or 4:
- a. in frequency bands between 1 GHz and 15 GHz
    - + 40 dBW in any 4 kHz band for  $\theta \leq 0^\circ$
    - +  $40 + 3\theta$  dBW in any 4 kHz band for  $0^\circ < \theta \leq 5^\circ$ ; and
  - b. in frequency bands above 15 GHz
    - + 64 dBW in any 1 MHz band for  $\theta \leq 0^\circ$
    - +  $64 + 3\theta$  dBW in any 1 MHz band for  $0^\circ < \theta \leq 5^\circ$ ;
- where  $\theta$  is the angle of elevation of the horizon viewed from the centre of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.
2. For angles of elevation of the horizon greater than  $5^\circ$  there shall be no restriction as to the e.i.r.p. transmitted by an earth station towards the horizon.
3. As an exception to the limits given in paragraph 1, the e.i.r.p. towards the horizon for an earth station in the space research service (deep space) shall not exceed +55 dBW in any 4 kHz band in frequency bands between 1 GHz and 15 GHz, or +79 dBW in any 1 MHz band in frequency bands above 15 GHz.
4. The limits given in paragraphs 1 and 3, as applicable, may be exceeded by not more than 10 dB. However, when the resulting coordination area extends into the territory of another country, such increase shall be subject to

agreement by the administration of that country.

5. The limits given in paragraph 1 apply, where applicable, to the services and frequency bands indicated in Table 8.2.35 below for transmission by earth stations where the frequency bands are shared with equal rights with the fixed or mobile service:

Table: 8.2.35	
Frequency band	Services
1761-1842	Fixed-satellite
2 025-2 110 MHz	Earth-exploration-satellite
7 900-7 975 MHz	Meteorological-satellite
8 025-8 400 MHz	Mobile-satellite
	Space operation
	Space research

#### 6. Earth Stations Operating in the 1610-1626.5 MHz Band

a. In accordance with No. **5.364** of the RR:

A mobile earth station operating in either the mobile-satellite service or radiodetermination-satellite service in the band 1610-1626.5 MHz shall not produce a peak e.i.r.p. density in excess of -15 dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. **5.366** (airborne electronic aids to air navigation and any directly associated ground-based or satellite-borne facilities) unless agreed by affected administrations.

In the part of the band where such systems are not operating, the mean e.i.r.p. density of a mobile earth station shall not exceed -3 dB(W/4 kHz).

b. The e.i.r.p. transmitted in any direction by an earth station in the radiodetermination-satellite service in the band 1610-1626.5 MHz shall not exceed -3 dBW in any 4 kHz band.

7. Earth station antennas shall not be employed for transmission at elevation angles of less than 3° measured from the horizontal plane to the direction of maximum radiation, except when agreed to by agencies or administrations concerned and those whose services may be affected. In case of reception by an earth station, the above value shall be used for coordination purposes if the operating angle of elevation is less than that value.

8. As an exception to paragraph 7, earth station antennas in the space research service (near Earth) shall not be employed for transmission at elevation angles of less than 5°, and earth station antennas in the space research service (deep space) shall not be employed for transmission at elevation angles of less than 10°, both angles being those measured from the horizontal plane to the direction of maximum radiation. In the case of reception by an earth station, the above values shall be used for coordination purposes if the operating angle of elevation is less than those values.

9. Earth Station Off-axis Power Limitations. The level of (e.i.r.p.) emitted by the earth station at angles in the direction the geostationary-satellite orbit off the mainbeam axis has a significant impact of interference caused to other geostationary satellite networks. Enhanced utilization of the geostationary-satellite orbit and easier coordination would be attained by minimizing such off-axis radiation and administrations are encouraged to achieve the lowest value practicable bearing in mind the latest studies, e.g, ITU-R Recommendations. Minimizing such levels is particularly important in intensively used uplink bands.

### 8.2.36 Power Flux-Density Limits

#### 1. Limits at the Surface of the Earth from Space Stations

a. The power flux-density at the surface of the Earth produced by emissions from a space station, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, shall not exceed the limit given in Table 8.2.36. The limit relates to the power flux-density which would be obtained under assumed free-space propagation conditions and applies to emissions by a space station of the service indicated where the frequency bands are shared with equal rights with the fixed or mobile service, unless otherwise stated.

Table: 8.2.36 (Section 1)					
Frequency Band	Service	Limit in dB(W/m <sup>2</sup> ) for Angle of Arrival (δ) Above the Horizontal Plane			Reference Bandwidth
		0°- 5°	5°- 70°	70°- 90°	
410-420 MHz	Space Research (S-S) (Limited to communications)	-153	-153 + 0.077 (δ - 5)	-148	4 kHz



	within 5 km of an orbiting manned space vehicle, see No. <b>5.268</b> )				
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**Table: 8.2.36 (Section 2)**

Frequency Band	Service	Limit in dB(W/m²) for Angle of Arrival (δ) Above the Horizontal Plane			Reference Bandwidth
		0°- 5°	5°- 25°	25°- 90°	
460 - 470 MHz	Earth Exploration-Satellite (S-E) allocation, see US201)	-152			4 kHz
1670 - 1700 MHz	Earth Exploration-Satellite Meteorological-Satellite	-133 (Value based on sharing with meteorological aids service)			1.5 MHz
1670 - 1690 MHz <sup>3)</sup>	Space Research (S-E)(S-S)	-154 <sup>2)</sup>	-154 + 0.5 (δ - 5) <sup>2)</sup>	-144 <sup>2)</sup>	4 kHz
1690 - 1700 MHz (Nos. 5.381 and 5.382)	Space Operation (S-E)(S-S)				
1700 - 1710 MHz	Earth Exploration-Satellite (S-E)(S-S)				
1761-1842 MHz <sup>5)</sup> (See G42)					
2025-2110 MHz <sup>5),6)</sup>					
2200-2300 MHz					
7250-7850 MHz	Fixed-Satellite (S-E) Meteorological-Satellite (S-E) Mobile-Satellite	-152	-152 + 0.5 (δ – 5)	-142	4 kHz
8 025-8500 MHz	Earth Exploration-Satellite (S-E) Space Research (S-E)	-150	-150 + 0.5 (δ -5)	-140	4 kHz
13.4-14.05 GHz <sup>5)</sup>	Space Research (Secondary allocation)	-152			4 kHz
14.5-15.35 GHz	Space Research (14.5-14.8 GHz is a secondary allocation)	-124	-124 + 0.5 (δ - 5)	-114	1 MHz
17.8-19.7 GHz <sup>1)</sup>	Fixed-Satellite (S-E) (geostationary-satellite orbit and NGSO constellation of 50 or fewer satellites)	-115 <sup>7) 8)</sup>	-115 + 0.5 (δ - 5) <sup>7) 8)</sup>	-105 <sup>7) 8)</sup>	1 MHz
17.8-19.3 GHz	Fixed-Satellite (S-E) (geostationary-satellite orbit and NGSO constellation of 51 or more satellites)	-115-X <sup>4) 8)</sup>	-115-X + ((10+X)/20) (δ – 5) <sup>4) 8)</sup>	-105 <sup>8)</sup>	1 MHz
18.6-18.8 GHz	Fixed-Satellite (S-E)	-95 This limit may be exceeded by up to 3 dB for no more than 5% of this time. (Value based on sharing with Earth exploration- satellite (passive) service and space research (passive) service. (See <b>US255</b> )			200 MHz
19.3 -19.7 GHz <sup>1)</sup> 22.55 - 23.55 GHz 24.45 - 24.75 GHz 25.25 - 27.5 GHz	Earth Exploration-Satellite (S-E) Inter-Satellite Space Research (S-E)	-115	-115 + 0.5 (δ-5)	-105	1 MHz
31.0-31.3 GHz	Space Research (see No. <b>5.544</b> )	–115	–115 + 0.5(δ – 5)	–105	1 MHz
31.8-32.3 GHz	Space Research	–120 <sup>9)</sup>	–120 + 0.75(δ – 5) <sup>9)</sup>	–105 <sup>9)</sup>	1 MHz

<b>Table: 8.2.36 (Section 2)</b>					
Frequency Band	Service	Limit in dB(W/m <sup>2</sup> ) for Angle of Arrival ( $\delta$ ) Above the Horizontal Plane			Reference Bandwidth
		0°- 5°	5°- 25°	25°- 90°	
35.5-36 GHz	Earth Exploration-Satellite (Active) Space Research (active) (see No. <b>5.549A</b> )	The mean power flux-density at the Earth's surface, generated by any spaceborne sensor, for any angle greater than 0.8° from the beam centre shall not exceed -73.3 dB(W/m <sup>2</sup> ) in this band			
37.0-38.0 GHz	Space Research (non-geostationary-satellite orbit)	-120 <sup>9)</sup>	-120 + 0.75 ( $\delta$ - 5) <sup>9)</sup>	-105	1 MHz
37-38 GHz	Space research (geostationary-satellite orbit)	-125	-125 + ( $\delta$ - 5)	-105	1 MHz
39.5-40 GHz	Fixed-satellite (non-geostationary-satellite orbit) Mobile-satellite (non-geostationary-satellite orbit)	-120 <sup>10) 11)</sup>	-120 + 0.75( $\delta$ - 5) <sup>10) 11)</sup>	-105 <sup>10) 11)</sup>	1 MHz
39.5-40 GHz	Fixed-satellite (geostationary-satellite orbit) Mobile-satellite (geostationary-satellite orbit)	-127 <sup>11)</sup>	5°-20° -127 + (4/3) ( $\delta$ - 5) <sup>11)</sup> 20°-25° -107 + 0.4 ( $\delta$ - 20) <sup>11)</sup>	-105 <sup>11)</sup>	1 MHz
40-40.5 GHz	Fixed-satellite	-115	-115 + 0.5 ( $\delta$ - 5)	-105	1 MHz
40.5-42 GHz	Fixed-satellite (non-geostationary-satellite orbit) Broadcasting-satellite (non-geostationary-satellite orbit)	-115 <sup>10) 11)</sup>	-115 + 0.5 ( $\delta$ - 5) <sup>10) 11)</sup>	-105 <sup>10) 11)</sup>	1 MHz
40.5-42 GHz	Fixed-satellite (geostationary-satellite orbit) Broadcasting-satellite (geostationary-satellite orbit)	-120 <sup>10)</sup>	5°-15° -120 + ( $\delta$ - 5) <sup>10)</sup> 15°-25° -110 + 0.5 ( $\delta$ - 15) <sup>10)</sup>	-105 <sup>10)</sup>	1 MHz
48.2-48.54 GHz 49.44-50.2 GHz	Fixed-Satellite (geostationary-satellite orbit)	The power flux-density in the band 48.94-49.04 GHz produced by any geostationary space station in the fixed-satellite service (space-to-Earth) operating in the bands 48.2-48.54 GHz and 49.44-50.2 GHz shall not exceed -151.8 dB(W/m <sup>2</sup> ) in any 500 kHz band at the site of any radio astronomy station. (See No. <b>5.555B</b> )			500 kHz
54.25-56.9 GHz 56.9-57 GHz 57-58.2 GHz 59-59.3 GHz	Inter-Satellite (geostationary-satellite orbit)	The single-entry power flux-density at all altitudes from 0 km to 1000 km above the Earth's surface produced by a space station, for all conditions and for all methods of modulation, shall not exceed -147 dB(W/(m <sup>2</sup> · 100 MHz)) for all angles of arrival. (see No. <b>5.556A</b> and <b>G128</b> ) (Value based on sharing with NGSO space research (passive) and Earth exploration-satellite (passive) services)			100 MHz
116-122.25 GHz	Inter-Satellite (geostationary-satellite orbit)	The single-entry power flux-density produced by a space station, for all conditions and for all methods of modulation, at all altitudes from 0 km to 1000 km above the Earth's surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, shall not exceed -148 dB (W/m <sup>2</sup> · MHz)) for all angles of arrival. (see No. <b>5.562C</b> ) (Value based on sharing with GSO and NGSO space research (passive) and Earth exploration-satellite (passive) services)			1 MHz

Table: 8.2.36 (Section 2)					
Frequency Band	Service	Limit in dB(W/m <sup>2</sup> ) for Angle of Arrival (δ) Above the Horizontal Plane			Reference Bandwidth
		0°- 5°	5°- 25°	25°- 90°	
174.8-182 GHz	Inter-Satellite (geostationary-satellite orbit)	The single-entry power flux-density produced by a space station, for all conditions and for all methods of modulation, at all altitudes from 0 to 1000 km above the Earth’s surface and in the vicinity of all geostationary orbital positions occupied by passive sensors, shall not exceed -144 dB(W/(m <sup>2</sup> · MHz)) for all angles of arrival. (Value based on sharing with GSO and NGSO space research (passive) and Earth exploration-satellite (passive) services)			1 MHz

<sup>1)</sup> The equality of right to operate when a frequency band is allocated in different regions to different services of the same category is established in No. 4.8. Therefore, any limits concerning inter-regional interference which may appear in ITU-R Recommendations should, as far as practicable, be observed by administrations.

<sup>2)</sup> These power flux-density values are derived on the basis of protecting the fixed service using line-of-sight techniques. Where a fixed service using tropospheric scatter operates in the bands listed in the first column and there is insufficient frequency separation, there must be sufficient angular separation between the direction to the space station and the direction of maximum radiation of the antenna of the receiving station of the fixed service using tropospheric scatter, in order to ensure that the interference power at the receiver input of the fixed-service station does not exceed - 168 dBW in any 4 kHz band.

<sup>3)</sup> These values are applicable where this band is shared with equal rights with meteorological aids service.

<sup>4)</sup> X is defined as a function of the number of satellites, n, in an NGSO constellation as follows:

For  $n \leq 288$ ,  $X = (5/119) (n - 50)$  dB; and

For  $n > 288$ ,  $X = (1/69) (n + 402)$  dB.

<sup>5)</sup> The limits set forth in this table are applicable to the Space Transportation System and the Tracking and Data Relay Satellite System or any satellites or spaceborne radiocommunication transmitters associated with these systems. See IRAC Doc. 22860.

<sup>6)</sup> Limits may be exceeded by 3 dB in the U.S., see IRAC Doc. 22860.

<sup>7)</sup> These limits apply to emissions of a geostationary space station in the meteorological-satellite service.

<sup>8)</sup> See US334.

<sup>9)</sup> During the launch and near-Earth operational phase of deep-space facilities, non-geostationary satellite systems in the space research service shall not exceed a power flux-density value of:

-115 dB(W/m<sup>2</sup>) for  $\delta < 5^\circ$

-115 + 0.5 ( $\delta - 5$ ) dB(W/m<sup>2</sup>) for  $5^\circ \leq \delta \leq 25^\circ$

-105 dB(W/m<sup>2</sup>) for  $\delta > 25^\circ$

in any 1 MHz band, where  $\delta$  is the angle of arrival above the horizontal plane.

<sup>10)</sup> The values given in this table entry shall apply to emissions of space stations of non-geostationary satellites in systems operating with 99 or fewer satellites. Further study concerning the applicability of these values is necessary in order to apply them to systems operating with 100 or more satellites.

<sup>11)</sup> When addressing the sharing conditions between the fixed service and the fixed-satellite service in the bands 39.5-40 GHz and 40.5-41 GHz, the power flux-density at the Earth's surface from any FSS satellite should be no greater than the level(s) required to meet the FSS link availability and performance objectives of the subject applications, taking into account the technical and operational requirements of the overall design of the satellite network. In any case, the levels shall not exceed the applicable power flux-density limits in Table 8.2.36.

b. The limits given in Table 8.2.36 may be exceeded on the territory of the US&P subject to NTIA approval or of any country whose administration has so agreed.

## 2. Radio Astronomy in the Shielded Zone of the Moon

a. The shielded zone of the Moon comprises the area of the surface of the Moon and an adjacent volume of space which are shielded from emissions originating within a distance of 100000 km from the center of the Earth.

b. In the shielded zone of the Moon emissions causing harmful interference to radio astronomy observations and to other users of passive services shall be prohibited in the entire frequency spectrum except in the following bands:

(1) the frequency bands allocated to the space research service using active sensors;

(2) the frequency bands allocated to the space operation service, the Earth exploration-satellite service using active sensors, and the radiolocation service using stations on spaceborne platforms, which are required for the support of space research, as well as for radiocommunications and space research transmissions within the lunar shielded zone.

c. The level of harmful interference is determined by agreement between the administrations concerned, with the guidance of the relevant ITU-R Recommendations.

d. In frequency bands in which emissions are not prohibited by sub-paragraphs (a)-(c), radio astronomy observations and passive space research in the shielded zone of the Moon may be protected from harmful interference by agreement between administrations concerned.

### **8.2.37 Control of Interference between Geostationary-Satellite Systems and Non-Synchronous Inclined Orbit-Satellite Systems**

1. Non-geostationary space stations shall cease or reduce to a negligible level their emissions, and their associated earth stations shall not transmit to them, whenever there is unacceptable interference<sup>10</sup> to geostationary-satellite space systems in the fixed-satellite service operating in accordance with these regulations.

2. Whenever the emissions from geostationary satellites in the inter-satellite service operating in the bands 22.55-23.55, 24.45-24.75, and 25.25-27.5 GHz are directed towards space stations at distances from Earth greater than that of the geostationary-satellite orbit, the boresight of the antenna mainbeam of the geostationary satellite shall not be pointed within 15° of any point on the geostationary-satellite orbit.

3. In the frequency band 8025-8400 MHz, which the Earth exploration-satellite service using non-geostationary satellites shares with the fixed-satellite service (Earth-to-space) or the meteorological-satellite service (Earth-to-space), the maximum power flux-density produced at the geostationary-satellite orbit by any Earth exploration-satellite service space station shall not exceed -174 dB(W/m<sup>2</sup>) in any 4 kHz band.

### **8.2.38 Station Keeping of Space Stations**

1. Space stations on geostationary satellites shall have the capability of maintaining their positions within the tolerance specified. In the case of space stations on board geosynchronous satellites with circular orbits having an angle of inclination greater than 5 degrees, the positional tolerance shall relate to the nodal point.

2. Space stations on board geostationary satellites which use any frequency band allocated to the fixed-satellite service or the broadcasting-satellite service:<sup>11</sup>

a. shall have the capability of maintaining their positions within 0.1 degrees of the longitude of their nominal positions;

b. shall maintain their positions within 0.1 degree of longitude of their normal positions; but

c. experimental stations on board geostationary satellites need not comply with a) or b) above, but shall maintain their positions within 0.5 degree of longitude of their nominal positions;

d. however, space stations need not comply with b) or c) above, as appropriate, as long as the satellite network to which the space station belongs does not cause unacceptable interference to any other satellite network whose space station complies with the limits given in b) and c) above.

3. Space stations on board geostationary satellites which do not use any frequency band allocated to the FSS or the broadcasting-satellite service:

a. shall have the capability of maintaining their positions within 0.5 degree of longitude of their nominal positions;

b. shall maintain their positions within 0.5 degree of longitude of their nominal positions; but

c. need not comply with b) above as long as the satellite network to which the space station belongs does not cause unacceptable interference to any other satellite network whose space station complies with the limits given in b) above.

4. Space stations<sup>12</sup> on board geostationary satellites which are put into service prior to 1 January 1987, with advance publication information for the network having been published before 1 January 1982, are exempted from

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<sup>10</sup> The level of accepted interference shall be fixed by agreement between the administrations/agencies concerned, using the relevant ITU-R Recommendations as a guide.

<sup>11</sup> Space stations in the broadcasting-satellite service on geostationary satellites operating in the band 11.7-12.7 GHz are exempted from these provisions but shall maintain their positions in accordance with Appendix 30 of the ITU Radio Regulations.

<sup>12</sup> Transmitting antennas of space stations in the broadcasting-satellite service operating in the band 11.7-12.7 GHz are not subject to these provisions but shall maintain their pointing accuracy in accordance with Section 3.14.1 of Annex 5 to Appendix 30 of the Radio Regulations.

provisions of paragraph 2 above; however, they:

- a. shall have the capability of maintaining their positions within 1 degree of the longitude of their nominal positions; but efforts should be made to achieve a capability of maintaining their positions at least within 0.5 degree of the longitude of their nominal positions;
- b. shall maintain their positions within  $\pm 0.1$  degree of the longitude of their nominal positions; but
- c. need not comply with b) above as long as the satellite network to which the space station belongs does not cause unacceptable interference to any other satellite network whose space station complies with the limits given in b) above.

### **8.2.39 Pointing Accuracy of Antennas on Geostationary Satellites**

1. The pointing direction of maximum radiation of any earthward beam of antennas (intended for less than Earth coverage) on geostationary satellites shall be capable of being maintained within:
  - a. 10% of the half power beamwidth relative to the nominal pointing direction or
  - b. 0.3 degree relative to the nominal pointing direction, whichever is greater.<sup>12</sup>
2. In the event that the beam is not rotationally symmetrical about the axis of maximum radiation, the tolerance in any plane containing this axis shall be related to the half power beamwidth in that plane.
3. This accuracy shall be maintained only if it is required to avoid unacceptable interference<sup>12</sup> to the other systems.

### **8.2.40 Space Research in Bands Other Than Those Allocated to the Space Research Service**

In carrying out space developmental responsibilities, it is necessary and desirable that NASA conduct research by and on space techniques, especially in bands allocated to the various space services. Thus NASA may find it necessary to propose satellite research in various federal and non-federal bands. In general, assignments to space research space and earth stations will be experimental, i.e., on a non-interference basis to operational systems in accordance with the Table of Frequency Allocations.

### **8.2.41 Space Systems Using Necessary Bandwidths Greater Than 5 MHz for Transmissions from Space in the Band 2200-2290 MHz**

1. In the band 2200-2290 MHz, space-to-Earth and space-to-space operations should make use of transmissions that have necessary bandwidths constrained to no more than 5 MHz. For transmissions that require necessary bandwidths of greater than 5 MHz, the requesting agency shall submit justification on why a bandwidth exceeding 5 MHz is necessary; furthermore agencies are to explain why the radiocommunications requirement cannot be satisfied through use of transmissions using less bandwidth, i.e., 5 MHz or less, e.g., through use of more spectrally efficient modulation. Spread spectrum missions (e.g., space-to-Tracking and Data Relay Satellite, communications and lunar downlink, and lunar data relay satellite communications) that enable multiple users on the same channel and require a necessary bandwidth of approximately 6.16 MHz are exempt from this policy.

2. Agencies intending to use wide necessary bandwidths are to submit justification for the wide bandwidths to the Spectrum Planning Subcommittee, whenever the bandwidths of transmissions in the band 2200-2290 MHz from space stations exceed 5 MHz. The information will be subject to SPS review in association with requests for certification of spectrum support for such systems, in accordance with direction contained Chapter 10 of the NTIA Manual. Specific data requirements are contained in Section 10.8.2A of this manual.

### **8.2.42 Wildlife and Ocean Buoy Tracking and Telemetry**

1. Pursuant to footnote US210 to the National Table of Frequency Allocations, the use of frequencies in the bands 40.66-40.70 and 216-220 MHz may be authorized to U.S. federal and non-federal stations on a secondary basis for the tracking of, and telemetry of scientific data from, ocean buoys and wildlife, subject to the following conditions:

- a. Airborne wildlife telemetry in the band 216-220 MHz will be authorized in only the 216.0-216.1 MHz portion of the band. After January 1, 2002, no new assignments shall be authorized in the band 216-217 MHz.
- b. All transmitters shall be FCC type accepted, or the equivalent, as specified in 47 CFR 90.248.
- c. Classes of emission shall be limited to N0N, A1D, A2D, F1D, F2D, F9D.

- d. Occupied bandwidth shall not exceed 1 kHz.
- e. Maximum carrier power shall not exceed 1 milliwatt for airborne wildlife applications, 10 milliwatts for terrestrial wildlife applications, and 100 milliwatts for ocean buoys.
- f. In the band 216-220 MHz, the carrier frequency shall be maintained within 0.005 percent of the assigned frequency.
- g. In the band 40.66-40.70 MHz, the bandwidth required for frequency tolerance plus the occupied bandwidth of any emissions must be adjusted so as to be confined within this band, except as permitted by paragraph h below.
- h. The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:
  - (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 decibels;
  - (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 decibels;
  - (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth; at least 43 plus  $10 \log_{10}$  (mean output power in watts) decibels or 80 decibels, whichever is the lesser attenuation.
- 2. Wildlife telemetry in the 162-174 MHz band are authorized on a unprotected, non-interfering basis for the tracking of, and the telemetering from, wildlife. Multiple agency operations will be conducted under a Memorandum of Agreement between cooperating agencies and subject to the following conditions:
  - a. Radio frequency assignments on specific operational frequencies are maintained in the GMF.
  - b. Class of emission shall be limited to VID.
  - c. Authorized bandwidth shall not exceed 1 kHz.
  - d. Maximum carrier power shall not exceed 10 mW.
  - e. The carrier frequency shall be maintained within 0.003 percent of the assigned frequency.

### **8.2.43 Frequency Assignments to Transportable Earth Stations in the 7300-7750 and 8025-8400 MHz Bands**

Frequency assignments to transportable earth stations in the bands 7300-7750 and 8025-8400 MHz will be on a temporary/renewable basis with an expiration date not to exceed five years. These assignments may be used over a small geographical area, normally this area will not be in excess of radius of 48 kilometers from the assignment location. Operations within the confines of this geographical area may be restricted if such operations are in conflict with existing uses in the band. These area assignments may be further restricted if new requirements for authorized services indicate such restrictions are required in order to provide for compatible operations. In addition, those assignments for transportable operations (Special Note S362) in the bands 7300-7750 and 8025-8400 MHz shall bear the Special Note S370 (See Annex A).

### **8.2.44 Launch Vehicles Telemetering**

Launch vehicles are hybrid vehicles used to transport objects, including spacecraft, beyond the Earth's atmosphere, either into orbit around the Earth or to some other destination in outer space. The telemetry system on the first stage of a launch vehicle is considered an aeronautical mobile system as it starts from the ground and ascends until the second stage and or any other upper stages of the rocket is engaged. Launch vehicles,

1. During the first stage of a launch (first 15 minutes of the flight) operate in the aeronautical mobile service and with the MOEB (Flight Telemetry Mobile) station class subject to the telemetering plan in Section 4.3.4 of the NTIA Manual.
2. During the second stage or higher stages of a launch, operate in the space operation service with an ET (space) station class or an ER station class for space telemetering. In the band 2200-2290 MHz, such systems are also subject to Section 8.2.41 of the NTIA Manual.

### **8.2.45 Frequency Assignments to Mobile Stations in Certain Frequency Bands Shared with Passive Sensors**

Remote sensing operations conducted in the Earth Exploration-Satellite Service (passive) and the Space Research Service (passive) can be disrupted if interference power level arriving at the sensor approaches the level

of natural radiation being measured by the sensor. Mobile systems have the potential for creating an interference environment which could make sharing with passive sensors difficult. Therefore, although US263 provisions apply, agencies requesting frequency assignments for mobile stations operating with transmitter powers in excess of 2 watts will consider other mobile bands to meet the required operation before assignments are requested in the following bands:

21.2-21.4 GHz      22.21-22.5 GHz      36-37 GHz      56.26-58.2 GHz

#### **8.2.46 Radiolocation Operations in the Band 15.7-17.3 GHz**

Airborne radars, except those authorized before January 1983, shall have the capability to cease operation in the 15.7 to 16.2 GHz band when within a minimum distance of the airport surface detection equipment (ASDE) determined for each new airborne radar system when NTIA certifies spectrum support for that system.

#### **8.2.47 Shared Federal/Non-Federal Radio Systems**

The term "shared system" as used in this section means a radio system using one or more frequencies authorized by the NTIA and one or more frequencies licensed by the FCC. "Agreement" or "Agreements," as specified in this section refer to Memorandums or Letters of Understanding or Agreement between federal agencies and non-federal partners. Shared systems may be authorized under the following conditions (Operations conducted under Section 7.12 or Section 12.8 of the Manual, which allow a federal radio station to utilize any frequency authorized to a non-federal radio station under specified conditions, are exempt from this policy.). The federal agencies signing the agreement shall:

a. prior to signing any agreement, submit to the IRAC, for information and planning purposes, a copy of any agreement which has been coordinated between the parties to the agreement. The Agreement shall state that it is contingent on NTIA's approval of any supporting certifications, authorizations, or modifications. The Agreement shall contain conditions for the return of frequencies authorized by NTIA in the event that NTIA determines that: the frequencies can no longer be made available for non-federal use, all federal participants withdraw from the shared system, or the return is required for convenience of the government.

b. obtain spectrum certification from NTIA prior to requesting authorization for frequency assignments from NTIA.

c. in accordance with the procedures specified in Chapter 10, submit a request for system review to the Spectrum Planning Subcommittee (SPS) for the proposed shared system and obtain NTIA Certification of Spectrum Support. The following information shall be submitted to the SPS: In accordance with Section 10.1.3 of this manual, a request for certification of spectrum support for the proposed system; a frequency plan for federal spectrum access requirements; and a copy of the signed agreement between the requesting federal agency and the non-federal system partner. If equipment to be used by the federal agencies has already been certified, it is sufficient to provide the SPS numbers of the certifications in lieu of detailed equipment characteristics. Upon receipt of NTIA certification, agencies may submit requests for permanent frequency assignments or modification to existing assignments to support the shared system.

d. apply for frequency authorizations in accordance with Chapter 9 of this Manual. In addition, federal agencies:

(1) shall obtain authorizations from NTIA for all frequencies (regardless of the frequency band) that will be used by federal stations;

(2) may request authorization for a band assignment vice discrete frequency assignments for spectrum used by the shared system and allocated for non-federal use, e.g., 150.8-162.0125 MHz;

(3) shall make the non-federal partner aware that, in order to have access to spectrum allocated to the Federal Government, the non-federal partner must obtain an FCC license through the normal FCC licensing process (this application will be coordinated by the FCC through the Frequency Assignment Subcommittee); and

(4) shall include in their proposals:

(i) Remarks line that shows the joint operations by the agency, non-federal, and other agencies:

*Example:* REM05 \*JNT,I , NG , J , A , DHS

(ii) Information in the supplementary details identifying the agreement reached between the federal agency(ies) and non-federal partners:

*Example:* SUP01 DOI and Wyoming Agreement 6 Dec 2006

(iii) Special Note S402:

NTS01 S402

(iv) \*NTS, M015 entry with the IRAC and SPS document numbers for this system:

*Example:* REM07 \*NTS,M015,IRAC 33221/4,SPS 13928/4

(v) Paired frequency data referencing the system-wide FCC spectrum band assignment:

*Example:* REM03 \*PRD,M150.8000,I 080001

(vi) Supplementary remarks listing each maritime frequency or two digit maritime channel number used, if maritime frequencies are included in a band assignment:

*Example:* SUP02 Marine Channel XX included in band assignment

(vii) When a band assignment is used for spectrum allocated for non-federal use, the assignment must list the individual frequencies in the supplementary details or reference an FAS document that contains the individual frequencies in the circuit remarks M001 entry:

*Examples:*

SUP01 FCC licensed frequencies in use, MXXX.XXXX,  
REM05 \*NTS, M001,FAS,XXXXXX

e. have (1) an assignment for each frequency which is allocated on a primary basis for federal use; and (2) individual assignments or a band assignment for operations allocated on a non-primary basis for federal use.

f. ensure that the non-federal partner has FCC licenses for operations on frequencies which are allocated on a primary basis for federal use.

## **8.2.48 Trunked Land-Mobile Radio Systems**

1. Trunked land-mobile radio systems may be established in any frequency band allocated for federal use on a primary basis for the fixed and mobile services. Accommodating a trunked system requires consolidation of existing land mobile systems by the applicant(s) unless they present justification.

2. Trunked land-mobile radio systems may be established by an individual agency or cooperatively by several agencies. Innovative methods of using commercial entities to design and operate trunking systems under sponsorship of one or more federal agencies are encouraged. Frequency assignments for shared trunked land-mobile radiocommunication systems shall be obtained by the installing, sponsoring or lead agency which is responsible for managing the system. Individual user agencies are not required to obtain frequency assignments to share the system if operated in accordance with provisions of Paragraph 4, Section 9.1.2.

3. Trunked land mobile systems will be submitted to the Spectrum Planning Subcommittee for system review prior to application for frequency assignment. This system review is based on the need to consider the system as a whole, which is not possible with the unconnected and separate frequency proposals made to the FAS. Data requirements for SPS submission are contained in Section 10.9.

4. Federal agencies managing trunked systems shall allow access to the trunked systems by other agencies where such access is technically and operationally feasible.

### **8.2.48A Land Mobile Radio Communications**

1. Federal Government agencies implementing new land mobile communication systems and replacing aging



ones should use available commercially offered land mobile services, or share land mobile services operated by other federal, state or local government agencies whenever possible. When commercial or shared systems are unavailable, their use would not meet mission requirements, would cause unacceptable delays or disruptions, or would cost more than operating their own system, federal agencies may operate their own spectrum-efficient, cost-effective systems.

2. The provisions in paragraphs 8.2.48A, 3 to 6 apply to land-mobile systems operating in frequency bands above 30 MHz. Systems defined as tactical and training as explained in Section 8.2.12 are not included, however, those supporting training operations are included.

3. Agencies seeking to operate their own new land-mobile radiocommunication systems shall, before obtaining frequency assignment authorizations, establish and document their requirements. Agencies should first conduct a requirements analysis commensurate with the size and complexity of their need. Using the results of the requirements analysis as the basis, agencies shall conduct an analysis of alternatives to operating their own land mobile system commensurate with the size and complexity of the requirement to identify the most advantageous alternative to the government. The analysis should address the use of NTIA-authorized trunked land mobile communication systems operated by other agencies or commercial services providers, and commercially offered land mobile radio services to determine their ability to meet mission requirements. This analysis shall be documented and retained by the submitting agency.

4. As a function of their oversight responsibility, NTIA will review authorization requests for selected land mobile systems prior to radio frequency authorization and may require the agency to submit the retained analysis documentation. On a case-by-case basis, NTIA may require additional information including written technical details on the analysis undertaken by the applicant agency.

5. All requests for frequency assignments to support federally owned and operated conventional or trunked land mobile radio systems within 30 km of an existing NTIA-authorized trunked land-mobile system, whether operated by a federal agency or a commercial vendor, shall be accompanied by a justification that indicates why use of the existing system could not meet agency requirements. The agency FAS representative will be the primary point of contact, unless another federal official is identified, for obtaining additional information regarding the selection of a separate system. Criteria for selecting a separate system include:

a. Communications services are required in areas where the existing system cannot provide service, its use would not meet mission requirements, would cause unacceptable delays or disruptions, or would cost more than operating a separate system.

b. The existing system cannot provide the type or quality of service required, its use would not meet mission requirements, would cause unacceptable delays or disruptions, or would cost more than operating a separate system.

c. A separate system is required to fill a gap in the existing system, which will be generally used to meet the applicant's requirements.

## **8.2.49 Reserved**

### **8.2.50 Federal/Non-Federal Frequency Sharing in the 932-935 MHz and 941-944 MHz Bands**

The bands 932-935 MHz and 941-944 MHz are shared by the federal and non-federal on a co-equal basis for the Fixed Service. Applications for assignments in these bands will be processed on a daily basis, and assignments will be made based on a first come, first-served basis. Therefore, if a non-federal application is filed one or more days before a federal application, the non-federal application will be granted. The converse therefore also applies. If a situation arises where federal and non-federal applications are filed on the same day for the same frequency to be used in the same geographic location (mutually exclusive applications), and agreements cannot be made to satisfy one or both applicants, then a joint lottery shall be held to determine whether the federal or non-federal entity shall be assigned the frequency.

### **8.2.51 Redeployment Requirement of Weather Radars**

Within the bands 2700-2900 MHz and 5350-5650 MHz, conventional magnetron or coaxial magnetron output tubes used in WSR-57, WSR-74S, WSR-74C, AN/FPQ-21 and AN/FPS-77 weather radars have inherent spurious emission levels that may cause radio frequency interference to digital radio-relay microwave systems in the 3700-4200 MHz and 5925-6425 MHz range. Prior to redeployment of these weather radars by any federal agency, an RF waveguide filter which reduces the spurious emission levels by at least 40 dB shall be installed.

## **8.2.52 Federal Use of the Band 220-222 MHz**

1. Frequencies in the 220-222 MHz band are available for land mobile use for both federal and non-federal operations. This section sets out the policies and procedures governing the authorization and use of federal systems operating in the 220-222 MHz band.

2. All federal systems operating in this band will be submitted to the Spectrum Planning Subcommittee for systems review under the provisions of Chapter 10 prior to submission of requests for frequency assignment.

3. As set forth in Section 4.3.15, 2 blocks of 5 contiguous channel pairs have been set aside for exclusive federal use in the development of nationwide systems and 140 channel pairs set aside for shared federal and non-federal local use.

4. Each application for review of a system using a nationwide block must certify that within 10 years of receiving Certification of Spectrum Support from NTIA, the system will be fully constructed and all proposed channels in use. The application shall include a schedule for implementation of the system. The user shall file a systems progress report with the FAS and the SPS 2, 4, 6 and 10 years from the date of certification of spectrum support demonstrating compliance with the schedule. Failure to comply with the schedule will lead to forfeiture of existing assignments or curtailment of the Certification of Spectrum Support for use of the nationwide block of channels unless sufficient justification as to why a progress report was not submitted or schedule was not met.

5. Each application for review of a non-nationwide system shall include a schedule for implementation. The period for implementation shall normally be one year but extensions up to 3 years may be authorized upon full justification. The user shall file a systems progress report with the FAS and the SPS at the end of the implementation period approved in the Certification of Spectrum Support demonstrating compliance with the schedule. Failure to submit a progress report or comply with the approved schedule will lead to forfeiture of existing assignments or curtailment of the Certification of Spectrum Support unless sufficient justification as to why a progress report was not submitted or schedule was not met.

## **8.2.53 Tracking, Telemetry and Telecommand Operations**

The tracking, telemetry, and telecommand operations of a satellite network shall have Stage 4 NTIA spectrum certification and frequency assignments with operational station class(es) before the launch of the spacecraft. Agencies may request exemption from this requirement for small satellite systems used for experimental purposes. Requests for such an exemption should be submitted to the SPS for review when requesting Stage 2 Certification of Spectrum Support. Upon recommendation of the SPS, NTIA will consider requests to exempt satellite systems from the requirement to obtain Stage 4 spectrum certification on a case-by-case basis. In deciding whether to waive the requirement, NTIA will consider such factors as the cost of the system; the frequencies to be used for the tracking, telemetry, and telecommand functions, along with the frequency and duration of transmissions; orbital parameters; the concept of operations for the system; and the duration of the mission. Agencies should understand that satellites that are placed into orbit without receiving Stage 4 Certification of Spectrum Support for the tracking, telemetry, and telecommand operations will operate on an unprotected, noninterference basis and will be issued only experimental frequency assignments.

## **8.2.54 Policy on the Use of the Frequency Bands Between 420 and 450 MHz by Range Safety Operations**

Agencies may request frequency authorizations for range safety operations in the band 420-450 MHz for use on federal test ranges only. These frequency assignments normally are limited to 1 kW of mean transmit power. Requests for additional power must be coordinated with and agreed to by the FCC. Range safety operations at Vandenberg AFB, CA (to include Pillar Point AFS, CA and Laguna Peak Tracking Station, CA); White Sands Missile Range, NM; and Cape Canaveral AFS, FL (to include Jonathan Dickinson Missile Tracking Annex (JDMTA), FL) may be authorized up to 10 kW transmit power without FCC coordination.

## **8.2.55 Wideband and Narrowband Emission Level and Temporal Measurements in the Navstar Global Positioning System Frequency Bands**

1. Federal agencies requesting Stage 4 Spectrum Certification for systems operating in the 390-413 MHz, and 960-1710 MHz frequency bands must provide measurements of the emission levels generated in the frequency bands

used by the Navstar Global Positioning System. The measurements of the wideband emission levels expressed in units of dBW/MHz and narrowband emission levels expressed in units of dBW are required in the 1164-1240 MHz and 1559-1610 MHz frequency bands.

2. For pulsed systems operating in the 390-413 MHz, and 960-1710 MHz frequency bands, measurements of the temporal characteristics of the emissions in the 1164.45-1188.45 MHz, 1215.6-1239.6 MHz, and 1563.42-1587.42 MHz bands can also be provided.

3. For systems operating in the subject frequency bands, this requirement will become effective on July 1, 2009. Systems already operational, procured prior to July 1, 2009, or submitted for review by the SPS prior to July 1, 2009 will be exempt from this requirement.

### **8.2.56 Aeronautical Use by Mobile Stations of Frequencies in the Bands 162.05-173.2, 173.4-174, and 406.125-420 MHz on an Exceptional Basis**

Aircraft operations using this exception are operated occasionally and are not the primary use of the radio frequency operations. If a land or maritime mobile system is only used by aircraft on an exceptional basis, the authorization for the station should have a station class in the land mobile (ML) or maritime mobile (MS) service and the following provisions shall apply:

a. For the bands 162.0500-173.2, 173.4-174, and 406.1250-420 MHz, the transmitter output power should be the minimum required to provide the service, but must not exceed 10 watts.

b. The station class MA will not be entered on the GMF application since the operations are on an exceptional basis and are not protected.

c. These stations can only be operated within the coverage area of the associated land mobile or maritime mobile system and at a minimum altitude required to achieve satisfactory communications which should not exceed 3500 feet above ground level. This is required in order to reduce the potential of harmful interference to other users.

d. If interference is experienced by an authorized land or maritime station, the aircraft will cease transmissions immediately upon notification. It is the responsibility of the agency operating the aeronautical station to resolve any harmful interference that may be caused to other users. The radio astronomy service uses the band 406.1–410 MHz and is particularly susceptible to interference from airborne stations.

## **8.3 COORDINATION OF FREQUENCY USAGE**

It is the responsibility of the agency proposing a new frequency assignment or a new radio station (transmitting or receiving), for which protection is desired from the operation of the same or other radio services, to ascertain from other agencies that may be involved whether harmful interference is likely to be caused to or from such proposed operations as a result of the established operations of those agencies.

### **8.3.1 Basic Coordination Arrangement Between the IRAC and the FCC**

The arrangement described in Section 2.4 includes cooperation with respect to the coordination of frequency authorizations which would tend to cause interference to stations operations under the jurisdiction of the other party. With respect to the time agreed for review of frequency assignments requests, time periods less than 15 working days may apply as determined by the FAS.

### **8.3.2 Coordination of the Policy and Economic Aspects of Certain Federal Proposals to Use Non-Federal and Amateur Frequency Bands**

1. As stated in Section 4.1.2, a federal frequency assignment may be authorized in a non-federal band provided the assignment is coordinated with the FCC.

2. Federal use of non-federal frequency bands may involve policy and economic, as well as technical, considerations. In order that coordination of each of these aspects may be achieved in the assignment of frequencies to federal radio stations, within the US&P, which contemplate a) the use of a non-federal or amateur band above 25000 kHz, or b) the use of one or more frequencies below 25000 kHz which, because of probable impact upon assignments by the FCC, warrants special attention, the following procedures should be observed:

a. New uses not provided for by Chapter 7 and not covered by existing agreements with the FCC:

(1) The federal agency concerned may coordinate the proposed assignment informally with the FCC.

(2) If the matter can be readily resolved and if the FCC indicates that formal policy coordination with the Commission is not required, the agency desiring the assignment will submit an application to the IRAC for processing in accordance with established procedures.

(3) Should there be a problem which cannot be resolved informally, or should the FCC indicate that formal policy coordination with the Commission is necessary, the matter will be referred to NTIA by the federal agency concerned for appropriate action.

(4) Upon satisfactory completion of coordination with the FCC, NTIA will inform the federal agency concerned of the results and, upon acceptance by that agency of any conditions involved, instruct the IRAC to process the application, when filed by that agency, in accordance with established procedures.

3. Proposed assignments provided for by Chapter 7 or those which are within the scope of existing agreements with the FCC:

a. The federal agency concerned will submit an application to the IRAC for processing in accordance with established procedures, supplemented, if appropriate, by advance informal coordination with the FCC.

4. These procedures notwithstanding, any federal agency may refer any such matters to NTIA whenever the agency considers it desirable to do so.

### **8.3.3 Coordination of Frequencies Used for Communication with Non-Federal Stations Licensed Under Part 90 of the FCC Rules**

1. Provision is made in Section 7.12 for a federal radio station to use any frequency authorized to a non-federal radio station under 47 CFR, Part 90 of the rules of the FCC where such utilization is necessary for intercommunication with non-federal stations or required for coordination with non-federal activities, provided that, in the case of frequencies other than the non-federal National Interoperability Channels, a mutually-approved arrangement has been concluded between the federal agency concerned, the FCC, and the non-federal licensee involved.

2. Two steps are required to conclude a mutually-approved arrangement. The federal agency must obtain from the non-federal licensee a written certification that the federal operation is necessary, and, after receipt of the certification, the federal agency must coordinate the proposed usage with the FCC.

### **8.3.4 Coordination of Military Use of Non-Federal Bands at Test Ranges and for Tactical and Training Operations**

See section 7.15.3 and section 7.17.

### **8.3.5 Intra-Military Coordination of Frequency Applications**

1. U.S. Army, Navy, and Air Force dockets for the FAS agenda will have had complete military coordination and will normally be concurred in by the three military services at the FAS meetings.

2. If, due to unforeseen circumstances, it becomes necessary for one of the military services to request tabling of another military service's docket that appears on the regular agenda, the docket will be tabled. If there is no resolution at the next regular FAS meeting, the docket will be withdrawn unless the applicant requests referral to IRAC.

### **8.3.6 Coordination for the Use of Hydrologic Channels in the Bands 162-174 and 406.1-420 MHz**

1. The frequencies shown in paragraph 1 of Section 4.3.3 are primarily for hydrologic operations. Federal agencies may also use these frequencies for non-hydrologic purposes when all other possibilities (except AGA(4) channels) have been exhausted, and when such use will not conflict with present or probable future hydrologic operations. Validation of hydrologic use by the Hydrology Coordinator must be accomplished prior to the submission of any hydrologic proposal into the frequency assignment process.

a. The Hydrology Coordinator. The Hydrology Coordinator under the Subcommittee on Hydrology of the Federal Interagency Advisory Committee on Water Information is responsible for validating the hydrologic use.

b. Preparing Proposals for Submission to the Hydrology Coordinator. A federal agency having a requirement to use a hydrologic channel, whether for hydrologic or non-hydrologic purposes, shall prepare a proposal as outlined

in subparagraph a below. Additionally, if the frequency will be used to support hydrologic operations, the applicant shall comply with the special instructions in subparagraph b; if for non-hydrologic operations, the applicant shall comply with the provisions of subparagraph c.

(1) General Instructions. All proposals for the use of hydrologic channels shall consist of the following basic elements:

(a) An Application for Frequency Assignment Action, completed in accordance with Section 9.8 of this Manual. All such applicants shall bear Record Note C075.

(b) A cover letter containing (at a minimum) the name, mailing address, and telephone number of the applicant.

(2) Instructions for Hydrologic Proposals. If the frequency is to be used for hydrologic purposes, the applicant shall provide the following additional information in either the cover letter, the Agency Remarks (\*AGN) or Supplementary Details (SUP) fields of the application, or in a separate attachment to the proposal package:

(a) Type of station (i.e. relay, command, or sensing).

(b) Kind of data to be transmitted (e.g. river stage, precipitation, etc.).

(c) Type of transmission (i.e. voice, data, combination of voice and data, etc.)

(d) Operation schedule (e.g. on call, automatic for 15 minutes each hour, etc.).

(e) Latitude and longitude of the station.

(f) The name of the federal agency sponsoring this application, along with supporting documentation.

(3) Instructions for Non-Hydrologic Proposals. If the frequency is to be used for non-hydrologic purposes, the following instructions apply:

(a) Before deciding to use a hydrologic channel, the applicant must first go through the standard frequency selection process as described in the IRAC Supplement to the NTIA Manual:

--First choice shall be given to those frequencies which bear the applicant's own symbol;

--Second choice to those bearing the symbol AGA, except AGA(4) and AGA(8);

--Third choice to those bearing the symbol of another agency;

--Fourth choice to those bearing the symbol of AGA(8); and

--Fifth choice to those bearing the symbol of AGA(4).

(b) If the frequency is to be used exclusively in a point-to-point configuration (i.e. no mobile stations, either transmitting or receiving, are involved), the applicant shall include in the proposal a simplified network diagram showing how the frequency will be employed.

(4) *Instructions for Federal Agencies Sponsoring Non-Federal Entities.* Federal agencies may sponsor non-federal entities who want to use federal hydrologic frequencies. Non-federal entities' use of federal hydrologic frequencies on a secondary basis:

(a) The federal agency sponsoring a non-federal entity will provide a letter of endorsement that supports the hydrologic frequency usage. Qualified agencies include the Department of Commerce (i.e. the National Weather Service), the Department of the Interior (i.e. the U.S. Geological Survey), the Department of Agriculture (i.e. Forest Service), the Tennessee Valley Authority, and the U.S. Army Corps of Engineers.

(b) Non-federal entities who desire to operate stations on these frequencies obtain authorization from the FCC.

#### c. *The Coordination Process*

(1) *Submitting Proposals to the Hydrology Coordinator.* Submit the proposal and all required supporting documents in Portable Document Format (PDF) format electronically to: [hydro.radio.freq@noaa.gov](mailto:hydro.radio.freq@noaa.gov).

(2) *Hydrology Coordinator Review.* The Hydrology Coordinator reviews the proposed use and verifies the use of the frequency for hydrological purposes. The Hydrology Coordinator will email the applicant a letter of validation. The applicant will submit the proposal, this letter of validation, and all supporting documents into the frequency assignment process.

d. *Submitting Applications by the Federal Agencies to the FAS.* The requesting agency submits its Application for Frequency Assignment Action to the FAS after receipt of the letter of validation from the Hydrology Coordinator. Federal agencies will use their standard method to submit their applications for frequency assignments. (include in circuit remarks the date of the letter of validation and reference number.) Supporting documents required by the Hydrology Coordinator, such as maps and network diagrams, need not be submitted to the FAS. If the application appears on the FAS agenda before receipt of Hydrology Coordinator comments by the FAS Secretariat, the request will be tabled until the coordination process has been completed.

(1) *Non-Federal Applications.* The FCC shall ensure non-federal applications submitted to the FAS include the name or abbreviation (Annex G) of the sponsoring federal agency in the Circuit Remarks (\*AGN) or

SUP field.

(2) *Routine Modifications and 5-Year Reviews*. If the modification will appear on the routine FAS agenda, it need not be sent to the Hydrology Coordinator for re-coordination.

(3) *Significant Modifications*. If the modification will appear on the regular FAS agenda, the applicant will submit an Application for Frequency Assignment Action to the Hydrologic Coordinator. According to the nature of the modification, the coordinator will effect whatever coordination is considered necessary.

(4) *Wireless Microphone Systems*. Coordination with the Hydrology Coordinator is not required for wireless microphone systems using the channels listed in Section 4.3.2.

### **8.3.7 Coordination of Meteorological Aids Operations in the Bands 400.15-406 and 1668.4-1700 MHz**

1. The characteristic frequency drift of radiosonde equipment and the requirement for flexibility in the operation of radiosondes preclude effective suballocation, channeling, or the granting of authority to use specific frequencies in the bands 400.15-406 and 1668.4-1700 MHz. The shared use of these bands corresponds essentially, for interference considerations, to shared use of a single nominal center band frequency assignment.

2. Interference to the meteorological aids service that can result in spoiled observations is, by the nature of the service and the resources usually available, inherently difficult to identify and locate.

3. Mutual interference is possible between radiosondes operating simultaneously within 160 kilometers of each other. Line-of-sight distance to the horizon is greater than 480 kilometers from a radiosonde at an altitude of 15 kilometers.

4. Since these bands are available for the use of all federal agencies responsible for the conduct of meteorological observations, each agency shall take appropriate measures to avoid interference through local coordination of specific operations if interference is indicated.

5. In application of allocation footnote US99, whenever it is necessary to operate radiosondes in the band 1668.4-1670 MHz within the U.S., notification of the operations shall be sent, as far in advance as possible, to the Division of Astronomical Sciences, National Science Foundation, 4201 Wilson Boulevard, Room 1045, Arlington, VA 22230, with a copy to the Executive Secretary, IRAC.

### **8.3.7A Coordination of Geostationary Operational Environmental Satellite Terrestrial Data Collection Platforms**

Use of a Geostationary Operational Environmental Satellites (GOES) terrestrial Data Collection Platforms (DCP) in the band 401.7-402.4 MHz shall be coordinated and registered with the Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) office of National Environmental Satellite Data Information Service (NESDIS). There are two satellites in operation to receive data from DCP: GOES East at 75.2 degrees, which uses odd numbered channels; and GOES West at 137 degrees, which uses even number channels. The satellites collect data from the DCP at set time intervals and relays information to a central processing center. NESDIS controls all time slots and operating collection codes.

Since NESDIS controls all operations, codes, time slots and assigns the frequencies to be used to avoid interference, it has determined that collecting data on each location site is not necessary. Therefore, each agency may register the use of the GOES ground transmitters as an area assignment (US, USA, USP or a state) for large systems or spot locations for small systems on each frequency used. Each assignment must have an entry in the notes field of S594. For area assignments a circuit remark entry of \*NRM to indicate approximately how many transmitters are in the system and an additional note of S361 will be needed to indicate multiple transmitting stations in the system.

Agencies wishing to register a GOES data collection platform should contact NESDIS at the following address:

NOAA/NESDIS Office of Satellite and Product Operations  
NOAA Satellite Operations Facility  
4231 Suitland Road, Room 1646  
Suitland, MD 20746  
E-Mail: [GOES.DCS@NOAA.GOV](mailto:GOES.DCS@NOAA.GOV)

### 8.3.8 Coordination of Radio Operations in the Vicinity of Fort Huachuca, Arizona

1. In order to minimize possible mutual harmful interference between electronic tests of the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Arizona, and the transmissions of federal radio stations located in the vicinity of Fort Huachuca, each agency having radio operations in the coordination zone given below shall notify the Area Frequency Coordinator, Fort Huachuca, or the Army IRAC Representative, of the frequency, power, location, and type emission of the radio operations. In addition, the local address and telephone contact of the office or persons supervising or operating such stations should be reported if applicable. Transmissions of mobile stations located within 24 kilometers of Fort Huachuca (31°31'48"N, 110°21'05"W) shall be minimized to the extent feasible.

2. The coordination zone is the area bounded by connecting lines running along Highway 80 from Tucson to Bisbee, due south from Bisbee to the international border, west along the border to a point due south of Dateland, due north to Dateland, along Highway 80 from Dateland to Gila Bend, and along Highway 84 from Gila Bend to Tucson (traffic on Highways 80 and 84 excluded).

3. For the protection of the USAEPG, signal levels should not exceed the following limits within 24 kilometers of Fort Huachuca:

10-540 kHz	20 millivolts per meter
540-1600 kHz	50 millivolts per meter
1.6-20 MHz	20 millivolts per meter
20-54 MHz	50 millivolts per meter
54-148 MHz	20 millivolts per meter
above 148 MHz	50 microvolts per meter

### 8.3.9 Coordination of Assignments to Stations (Other than Mobile and Transportable) to be Located in the National Radio Quiet Zone

1. The National Radio Quiet Zone (NRQZ) was established in IRAC Document 3867/2, March 26, 1958, subparagraph (a), for the protection of radio astronomy observations. The NRQZ encompasses an area of approximately 33,700 square kilometers of Virginia and West Virginia as shown on the map, Figure 1. This area encloses:

- a. The National Radio Astronomy Observatory site at Green Bank, Pocahontas County, West Virginia, and
- b. The Sugar Grove Research Station site at Sugar Grove, Pendleton County, West Virginia. The mission of Sugar Grove Research Station is to conduct communications research and development for the National Security Agency and other DOD organizations.

2. In order to minimize harmful interference to operations at the sites designated above, all requests for frequency assignments to stations within the area:

South of 39°15'N  
North of 37°30'N  
West of 78°30'W  
East of 80°30'W

shall be coordinated by the applicant, prior to submission to NTIA with:

Director (Attn: Interference Office)  
National Radio Astronomy Observatory  
P.O. Box 2  
Green Bank, WV 24944  
Telephone 304-456-2107

Send by email to [nrqz@nrao.edu](mailto:nrqz@nrao.edu) all new applications and GMF modifications that may increase the potential of interference.

The National Radio Quiet Zone coordinator will reply to all coordination requests in approximately 30 days or less. All applications submitted to NTIA shall include in the supplementary remarks "NRQZ" followed by the NRQZ coordination number provided by the NRQZ coordinator, and the date that the NRQZ coordinator provided concurrence for the proposal. This supplementary information shall be included in the GMF entry for the authorization.



This procedure applies to all stations except mobile and transportable stations.

The reference coordinates for Green Bank are:

North latitude 38d 25m 59.2s (NAD83)

West longitude 79d 50m 23.4s (NAD83)

Height above terrain: 139.6 m

Terrain elevation above mean sea level (NAVD88): 806 m

Additional information about NRQZ and coordination is available at URL <http://www.gb.nrao.edu/nrqz>.

3. The Record Note C081 will be inserted in the NOTES (NTS) field on all such assignment requests. These assignment requests shall not be approved until notice of successful coordination has been received from the NRQZ coordinator.

### **8.3.10 Coordination of Assignments to Stations Located in the Vicinity of the U.S./Canada Borders**

1. The U.S./Canada Agreement relating to the Coordination and Use of Radio Frequencies above 30 MHz provides for the coordination by the IRAC with the Canadian Department of Communications of certain frequency assignments. The text of the applicable portion of the Agreement is given in Section 3.4. This agreement, in many cases, contains multiple coordination channels, e.g., assignments in the bands 1215-1400 MHz, 2700-3700 MHz, and 8500-10500 MHz are indicated in the Index of the Technical Annex to the agreement as being coordinated between the JCS on the U.S. side and CDS on also indicated as being coordinated by FAA with DOT, Canada. To ensure that comments concerning proposals received from Canada under the terms of the Agreement take into consideration the comments of other authorized U.S. coordination agencies, the agency receiving proposals from Canada will coordinate its reply to Canada with all U.S. agencies also indicated in the agreement as a coordination agency for the band or portion of the band in which the proposed frequency is located.

### **8.3.11 Coordination of Frequency Usage Outside the US&P**

1. To avoid harmful interference, federal agencies shall coordinate the use of frequencies by their stations located outside the US&P with the IRAC. Coordination ordinarily shall be limited to stations likely to cause harmful interference to those authorized by NTIA or the FCC. Coordination of the use of frequencies by military stations shall be subject to the requirements of military urgency and security. All U.S. Federal Government radio station operations in the Republic of Palau, Federated States of Micronesia or the Republic of the Marshall Islands shall be harmonized (coordinated) by the U.S. Competent Authority in accordance with Annex L. For operations of more than 30 consecutive days, upon agreement by the respective nation, entry in the GMF is required.

2. Other than those countries covered in Annex L, an agency initiating coordination in the FAS under this section may use either of these methods:

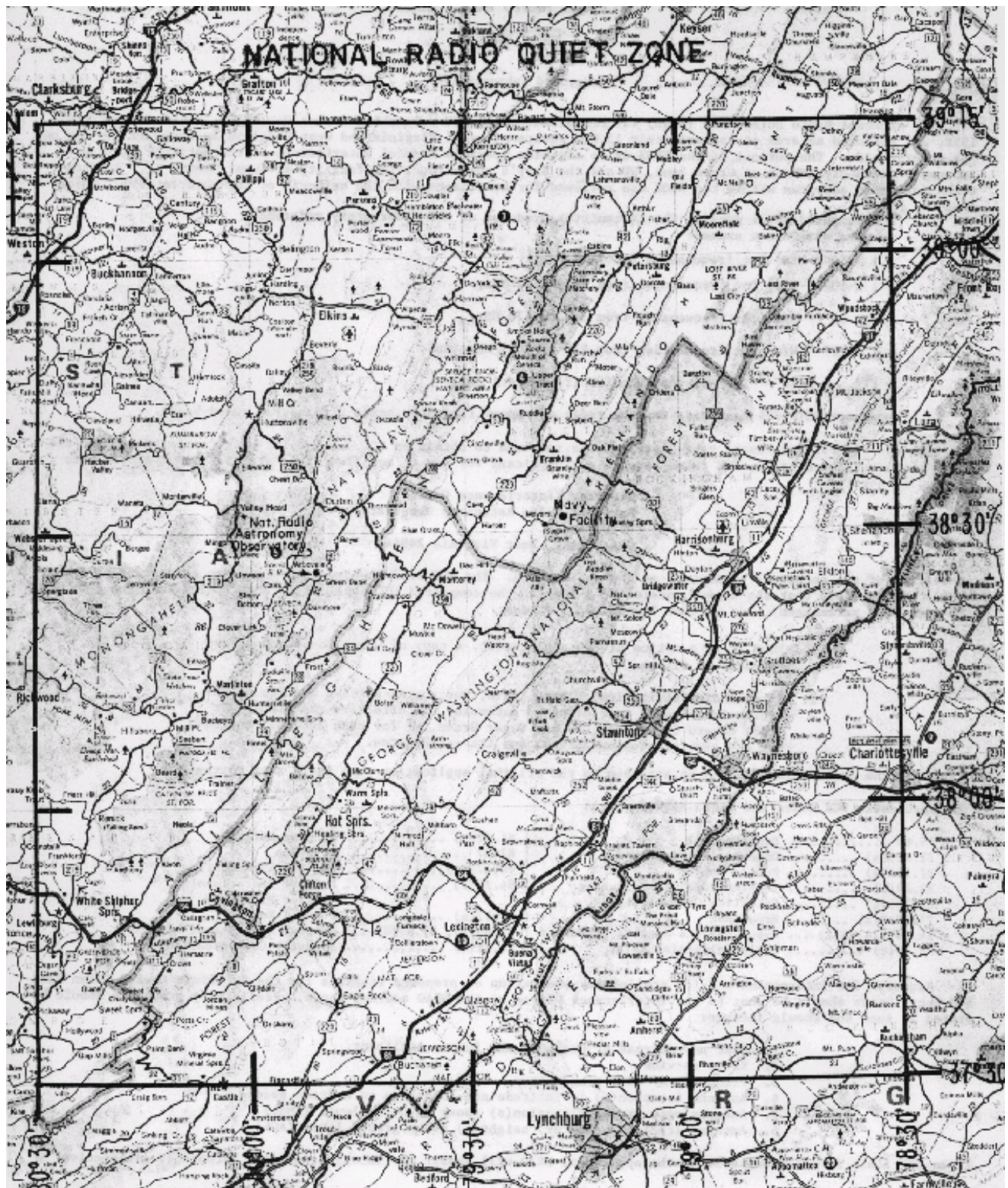
a. Use the procedures of Chapter 9 of the Manual with the Note S141 in the NOTES (NTS) field is desired when listing in the GMF; or

b. by memorandum providing the essential assignment details.

Enter any comments of the FAS in the FAS meeting minutes.



Figure 1: National Radio Quiet Zone



### **8.3.12 Coordination of Assignments for Transmissions by Terrestrial Stations Located Within the Coordination Area of a Receiving Earth Station**

#### *1. General Provisions*

a. Before an assignment to a terrestrial station is brought into use within the coordination area of a receiving earth station of another country utilizing the same band above 1 GHz allocated internationally with equal rights to terrestrial and space radiocommunication services (space-to-Earth) and within the bands listed in 2 below, coordination must be effected with that country to ensure interference will not be caused to the receiving earth station. (See **9.18** of the RR).

b. Nationally, the ITU RR procedure for coordinating terrestrial stations also is followed to identify possible interference to receiving earth stations located within the US&P.

#### *2. Frequency Bands*

a. The coordination procedure specified in this Section applies in the following frequency bands:

1215-1260 MHz, 1559-1610 MHz, 1670-1710 MHz, 2200-2300 MHz

3600-3650 MHz, 4500-4635 MHz, 4685-4800 MHz, 5150-5216 MHz

7250-7750 MHz, 8025-8500 MHz, 15.43-15.63 GHz, 25.50-27.00 GHz

37.00-38.00 GHz, 71.00-74.00 GHz, 102.0-105.0 GHz, 134.0-142.0 GHz

158.5-164.0 GHz, 191.8-200.0 GHz, 232.0-235.0 GHz

b. The procedure for obtaining terrestrial station frequency assignments located within the coordination area of a receiving earth station along the U.S./Canada and U.S./Mexico Borders has not yet been established for the 3500-3600 MHz frequency band.

#### *3. Specific Provisions*

a. For major terrestrial systems, or major modifications of existing systems, national and international coordination will be initiated during the systems review procedure outlined in Chapter 10. The SPS shall initiate coordination, as appropriate, with the country having the receiving earth station.

b. For assignments to terrestrial stations in systems not considered under the systems review procedure, Chapter 10, and to be located within the coordination area of a U.S. receiving earth station listed in Section 8.3.15, the applicant shall effect prior coordination with the agency operating the receiving earth station. In cases where such terrestrial stations are within the coordination area of a receiving earth station of another country listed in Section 8.3.15, the applicant shall provide to the FAS, in addition to the application for frequency assignment, the data required by No. **9.31** of the ITU RR. The FAS, as appropriate, shall initiate the international coordination required.

c. Final assignment action shall not be taken in the FAS until national coordination has been accomplished, and international coordination has been initiated, where it has been determined to be necessary.

d. The provisions of this section are equally applicable to any proposed change in the technical characteristics of a currently authorized frequency assignment for transmission by a terrestrial station, if the change increases the probability of harmful interference being caused by the terrestrial station.

e. Coordination pursuant to this section is not required for an experimental station or for a station whose frequency assignment would not be in accordance with the national or international Table of Frequency Allocations.

### **8.3.13 Coordination of Assignments for Transmission or Reception by Earth Stations**

#### *1. General Provisions*

a. Before an assignment to an earth station, whether for transmitting or receiving, is brought into use in a particular band allocated with equal rights to space and terrestrial radiocommunication services in the spectrum above 1 GHz and in the bands listed in 2a below, coordination must be effected with any country whose territory lies within the coordination area of the earth station to ensure that interference will not be caused to or by terrestrial stations. (See **9.17** of the RR). The coordination area is determined in accordance with Appendices **5** and **7** of the RR.

b. Before an assignment to an earth station, whether for transmitting or receiving, is brought into use in a particular band allocated with equal rights to space radiocommunication services in both directions of transmission and in the bands listed in 2b below, coordination must be affected with any country whose territory lies within the coordination area of the earth station or the earth station is located within the coordination area of a coordinated earth station to ensure that interference will not be caused to or by earth stations operating in the opposite direction



of transmission. (See No. **9.17A** of the RR.) The coordination area is determined based on Recommendations ITU-R IS.847, IS.848, and IS.849.

c. Nationally, the ITU RR procedure for coordinating earth stations also is followed to identify possible interference between such earth stations and terrestrial stations located within the US&P.

d. Agencies requiring earth station assignments must submit coordination contour data to the SPS as part of the system review procedure outlined in Chapter 10. This action is required when submitting Notices of Frequency Assignment for earth stations for use in international coordination and registration activities. Prior to NTIA assignment approval, the contour data for U.S. Federal Government earth stations must be published or approved for publication in Section 8.3.15 of this manual.

e. Agencies that have earth stations that require international coordination should consider purchasing the electronic version of Appendix 7 from the ITU Radiocommunication Bureau. This program can be used to determine whether an administration has coordinated with all affected administrations. The ITU also offers an electronic version of Recommendation ITU-R IS.847.

### *2. Frequency Bands*

a. (Earth Station/Terrestrial Station Coordination) The coordination procedure specified in sub-paragraph 1a of this section applies in the following frequency bands:

1215-1260 MHz, 1559-1610 MHz, 1610-1626.5 MHz, 1675-1710 MHz, 1761-1842 MHz, 2025-2120 MHz, 2200-2300 MHz, 7125-7235 MHz, 7250-7750 MHz\*, 7900-8500 MHz\*, 31.8-32.3 GHz, 34.2-34.7 GHz, 37-38 GHz, 39.5-40.0 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 44.2-50.2 GHz, 50.4-51.4 GHz, 66-71 GHz, 71-76 GHz, 81-86 GHz, 95-100 GHz, 123-130 GHz, 158.5-164 GHz, 167-174.5 GHz, 191.8-200 GHz, 209-226 GHz, 232-235 GHz, 238-240 GHz, 252-275 GHz

\* Nationally, coordination contours are not required in the bands 7250-7300 MHz and 7900-8025 MHz.

b. (Earth Station/Earth Station Coordination) The coordination procedure specified in sub-paragraph 1b of this section applies in the following frequency bands:

8025-8400 MHz, 19.3-19.7 GHz, 25.5-27 GHz, 40-40.5 GHz, 45.5-47 GHz, 66-71 GHz, 191.8-200 GHz, 238-240 GHz,

### *3. Specific Provisions*

a. International coordination relating to earth stations will be initiated by the SSS outlined in Section 3.3.2.

b. Applications for frequency assignments to earth stations shall indicate the status of coordination with affected agencies and countries. Final assignment action shall not be taken by the FAS until national coordination has been accomplished, and international coordination initiated where it has been determined to be necessary.

c. The provisions of this section are equally applicable to any proposed change in the technical characteristics of a currently authorized frequency assignment, for transmission or reception by an earth station, if the change increases the probability of harmful interference being caused to or by a terrestrial station or earth station, as appropriate.

## **8.3.14 Coordination of Assignments to Earth and Space Stations Which Utilize Geostationary-Satellites Networks**

### *1. General Provisions*

a. Before bringing into use an assignment to an earth or space station in a satellite network using the geostationary-satellite orbit (GSO), coordination must be effected, in certain cases, with other countries operating or planning such networks in the same band to ensure compatibility between different satellite networks. (See No. **9.7**). Coordination is required if the proposed satellite network would cause or receive a 6% or greater increase in receiving system or equivalent satellite-link noise temperature, as appropriate, with respect to other geostationary-satellite networks. (See RR Appendix 8)

b. Additionally, in certain frequency bands to which Nos. **9.11A** and **9.21** of the RR apply, coordination of frequency assignments to geostationary-satellite networks may be required with assignments of non-geostationary-satellite networks or systems or terrestrial stations.

c. Nationally, coordination of assignments to stations in satellite networks using the GSO is affected through the IRAC, SPS, and FAS processes, as appropriate.

### *2. Specific Provisions*

a. International coordination of satellite networks which utilize the GSO will be initiated by the SSS as outlined in Section 3.3.2.

b. For systems utilizing the GSO, which require international advance publication, under the provisions of No. 9.1, and coordination under the provisions of Nos. 9.7, 9.11A and 9.21, as appropriate, the SSS shall initiate advance publication and coordination with the Radiocommunication Bureau and the country(ies) involved.

c. Applications for frequency assignments to either earth or space stations in networks using the GSO shall indicate the status of coordination with agencies and countries having or planning space systems in the same band which employ the GSO. Final assignment action shall not be taken by the FAS until national coordination has been accomplished, and international coordination has been initiated, where it has been determined to be necessary.

### 8.3.14A Coordination of Assignments to Stations of Non-geostationary-Satellite Networks in Accordance with No. 9.11A of the ITU Radio Regulations

#### 1. General Provisions

a. Before bringing into use an assignment to an earth or space station in a geostationary or nongeostationary-satellite network, in bands subject to No. 9.11A, coordination must be affected, in certain cases, with other countries operating or planning geostationary-satellite networks, non-geostationary satellite networks or systems, or terrestrial stations, as appropriate, to ensure compatibility. The requirements for coordination are dependent on the frequency band concerned.

b. Nationally, coordination of assignments to stations of non-geostationary-satellite networks or systems is affected through the IRAC, SPS, and FAS processes, as appropriate.

#### 2. Specific Provisions

a. International coordination of non-geostationary-satellite networks or systems will be initiated by the SSS as outlined in Section 3.3.2.

b. For non-geostationary-satellite networks or systems which require international advance publication and coordination under the provisions of Nos. 9.1 and 9.11A, respectively, the SSS shall initiate advance publication and coordination with the Radiocommunication Bureau and the country(ies) involved.

c. Determination of the need for coordination between space stations (space-to-Earth) and terrestrial services sharing the same frequency band below 1 GHz.

Coordination of space station assignments in the 137-138 MHz and 400.15-401 MHz bands is required only if the power flux-density produced by the space station exceeds -125 dB(W/m<sup>2</sup>/4kHz) at the surface of the Earth.

d. Method for the determination of the need for coordination between MSS space stations (space-to-Earth) and terrestrial services sharing the same frequency band in the 1 to 3 GHz range

Coordination of transmitting space station assignments of the mobile-satellite service with respect to terrestrial services is not required if the power flux-density produced at the surface of the Earth or the fractional degradation in performance (FDP) of a station in the fixed service does not exceed the threshold values shown in the following table.

Table: 8.3.14A						
Frequency Band (MHz)	Service to be Protected	Coordination Threshold Values				
		Geostationary Space Stations		Non-Geostationay Space Stations		% FDP (in 1 MHz) (Note 1)
		power flux desity (pfd) (per space station) calculation factors (Note 2)		pfd (per space station) calculation factors (Note 2)		
		$P$ dB (W/m2) in 4 kHz	$r$ dB/deg	$P$ dB (W/m2)in 4 kHz	$r$ dB/deg	
1525 - 1530	Analog FS	-152	0.5	-152	0.5	25
	Digital FS	-152	0.5			
	Other terrestrial services (Note 4)	-152	0.5	-152	0.5	
2483.5 - 2500	Fixed	-152	0.5	-150	0.65	
	Other terrestrial services (Note 4)	-152	0.5	-150	0.65	

**NOTE 1:** The calculation of FDP (fractional degradation in performance) is contained in Resolution 46 Section A2.1.2.2.1, using reference FS parameters contained in Sections A2.1.2.2.2.1 and A2.1.2.2.2.3.

**NOTE 2:** The following formula should be used for deriving the coordination threshold in terms of power flux-density:

$$PdB(W / m^2 / 4kHz) \quad \text{for } \leq 0^\circ \delta \leq 5^\circ$$

$$P + r(\Delta - 5)dB(W / m^2 / 4kHz) \quad \text{for } \leq 5^\circ \delta \leq 25^\circ$$

$$P + 20dB(W / m^2 / 4kHz) \quad \text{for } \leq 25^\circ \delta \leq 90^\circ$$

where  $\delta$  is the angle of arrival (degrees).

The threshold values are obtained under assumed free-space propagation conditions.

**NOTE 3:** Not used

**NOTE 4:** The coordination threshold factors applicable to other terrestrial services may be reviewed at a future conference, as necessary.

e. Applications for frequency assignments to either earth or space stations in non-geostationary-satellite networks or systems shall indicate the status of coordination with affected agencies and countries. Final assignment action shall not be taken by the FAS until national coordination has been accomplished, and international coordination has been initiated, where it has been determined to be necessary.

### 8.3.14B Coordination of Assignments to Stations of Non-geostationary-Satellite Networks in Accordance with No. 9.21 of the ITU Radio Regulations

#### 1. General Provisions

a. Before bringing into use an assignment to an earth or space station in a non-geostationary-satellite network or system, in bands subject to No. 9.21, coordination must be affected, in certain cases, with other countries operating or planning geostationary-satellite networks, non-geostationary satellite networks or systems, or terrestrial stations, as appropriate, to ensure compatibility.

b. Nationally, coordination of assignments to stations of non-geostationary-satellite networks or systems is effected through the IRAC, SPS, and FAS processes, as appropriate.

#### 2. Specific Provisions

a. International coordination of non-geostationary-satellite networks or systems will be initiated by the SSS as outlined in section 3.3.2.

b. For non-geostationary-satellite networks or systems which require international advance publication and coordination under the provisions of Nos. 9.1 and 9.21, respectively,; the SSS shall initiate advance publication and coordination with the Radiocommunication Bureau and the country(ies) involved.

c. Applications for frequency assignments to either earth or space stations in non-geostationary-satellite networks or systems shall indicate the status of coordination with affected agencies and countries. Final assignment action shall not be taken by the FAS until national coordination has been accomplished, and international coordination has been initiated, where it has been determined to be necessary.

### 8.3.15 List of Coordinated Earth Stations

TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
1750-1850	CA, Camp Parks	374400N1215200W	1036	27198	Air Force
1750-1850	CO, Boulder	400010N1051600W	598	27198	Air Force
1760-1842	AK, Elmendorf AFB	611739N1494622W	446	44285	Air Force
1761-1842	CA, Azusa	341259N1175232W	525	33720	Air Force
1761-1842	CA, Huntington Beach	334506N1180214W	1046	40419	Air Force

TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/EAS DOCUMENT	AGENCY/ COUNTRY
1761-1842	CA, Huntington Beach	334450N1180204W	1172	43337	Air Force
1761-1842	CA, McClellan AFB	383959N1212333W	456	43337	Air Force
1761-1842	CA, Laguna Peak	340655N1190450W	913	28562	Navy
1761-1842	CA, McClellan AFB	383959N1212333W	400	40419	Air Force
1761-1842	CA, Vandenberg AFB	344924N1203154W	400	20037	Air Force
1761-1842	CA, Vandenberg AFB	344923N1203007W	1200	43333	Air Force
1761-1842	CA, Vandenberg VTS-A	344921N1203007W	1162	43335	Air Force
1761-1842	CA, Vandenberg VTS-B	344932N1203019W	1162	43335	Air Force
1761-1842	CO, Buckley AFB	3943XXN10446XXW	584	SPS-2916	Air Force
1761-1842	CO, Schriever AFB (Formerly Falcon AFB)	384754N1043128W	528	30274	Air Force
1761-1842	FL, Cape Canaveral	282909N0803430W	1012	28443	Air Force
1761-1842	FL, Key West	243239N0814817W	971	40419	Air Force
1761-1842	FL, Key West	243236N0814817W	1200	43337	Air Force
1761-1842	Guam, Andersen AFB	133648N1445112E	801	20037	Air Force
1761-1842	Guam, Anderson AFB	133654N1445122E	1200	43333	Air Force
1761-1842	Guam, Anderson GTS-A	133655N1445122E	1200	43335	Air Force
1761-1842	Guam, Anderson GTS-B	133657N1445130E	1200	43335	Air Force
1761-1842	Guam, Anderson GTS-C	133657N1445120E	1200	43335	Air Force
1761-1842	HI, Kaena Point	213418N1581634W	760	20037	Air Force
1761-1842	HI, Kaena Point	213343N1581431W	1200	43333	Air Force
1761-1842	HI, Kaena PA HTS-A	213342N1581426W	1200	43335	Air Force
1761-1842	HI, Kaena PA HTS-B	213408N1581544W	1200	43335	Air Force
1761-1842	MD, Blossom Point	382553N0770516W	997	29819	Navy
1761-1842	MD, Patuxent River NAS	381628N0762445W	880	40419	Air Force
1761-1842	MD, Patuxent River NAS	381628N0762445W	476	43337	Air Force
1761-1842	ME, Loring	4700XXN06810XXW	584	7321493	Air Force
1761-1842	ME, Prospect Harbor	442455N0680150W	992	28562	Navy
1761-1842	NC, Fort Bragg	350935N0785924W	415	40419	Air Force
1761-1842	NC, Fort Bragg	350904N0785913W	497	43337	Air Force
1761-1842	NH, New Boston	425654N0713824W	420	20037	Air Force
1761-1842	NH, New Boston	425646N0713744W	700	43333	Air Force
1761-1842	NH, New Boston NHS-A	425646N0713746W	670	43335	Air Force
1761-1842	NH, New Boston NHS-B	425652N0713736W	670	43335	Air Force
1761-1842	NH, New Boston NHS-C	425641N0713749W	670	43335	Air Force
1761-1842	NM, Kirtland AFB	350300N1062400W	426	30397	Air Force
1761-1842	NM, Kirtland AFB	345939N1063028W	428	40419	Air Force
1761-1842	TX, Fort Hood	310858N0974612W	400	40419	Air Force
1761-1842	TX, Fort Hood	310857N0974612W	456	43337	Air Force
1761-1842	VA, Fort Belvoir	384407N0770913W	900	37249	Air Force
1761-1842	VA, Quantico	382952N0772223W	1004	29819	Navy
1761-1842	WA, Fairchild	4734XXN11810XXW	584	7321494	Air Force
1761-1842	WA, Lewis-McChord	470611N1223311W	430	40419	Air Force
1761-1842	WA, Lewis-McChord	470611N1223311W	506	43337	Air Force
1763-1840	TX, Kelly AFB	294800N0983600W	1345	29873	Air Force
1766-1839	GA, Atlanta	335747N0840514W	400	36584	Air Force
1767	CA, Monterey	363600N1215324W	624	35566	Navy
1767	MD, Annapolis	385848N0792924W	504	35566	Navy
1780-1842	CA, Azusa	340733N1175538W	1024	41856	Air Force
1780-1842	GA, Duluth	335743N0840547W	463	44838	Air Force
1782.043- 1782.555	CA, Camp Parks	374357N1215250W	493	41856	Air Force

TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/EAS DOCUMENT	AGENCY/ COUNTRY
1782.043- 1782.555	Guam	133534N1445039E	746	41856	Air Force
1782.043- 1782.555	Guam	133455N1445034E	746	42268	Air Force
1782.043- 1782.555	HI, Wahiawa	213113N1575953W	1200	41856	Air Force
1782.043- 1782.555	HI, Kaena Point	213405N1581539W	1117	41856	Air Force
1783.740	FL, Cape GA CCAFB	282903N0803421W	1200	43336	Air Force
1783.740	RMI, Kwajalein Island	084323N1674353E	1200	44285	Air Force
1791.748	CA, Redondo Beach	335351N1182225W	1200	41856	Air Force
2025-2100	AK, Fairbanks	645826N1473021W	398	44838	Commerce
2025-2100	VA, Wallops Island	375624N0752812W	1200	44838	Commerce
2025-2100	AK, Barrow Point	711800N1563600W	900	39549	Commerce
2025-2100	AK, Fairbanks	644739N1473213W	431	43893	Air Force
2025-2100	AK, Fairbanks (NOAA CDAS)	645838N1473054W	500	20086	NASA
2025-2100	AK, Fairbanks	645123N1474917W	431	42215	Air Force
2025-2100	AK, Fairbanks	645131N1475127W	523	37751 34188	NASA
2025-2100	AK, Gilmore Creek	645826N1473007W	1375	39549	Commerce
2025-2100	AK, North Pole	644816N1473001W	514	44285	Air Force
2025-2100	AK, North Pole	644818N1473000W	500	30976	NASA
2025-2100	AK, Poker Flat	650700N1472742W	400	31927	NASA
2025-2100	AK, Poker Flat	650825N1473042W	500	29653 29585	NASA
2025-2100	AK, Poker Flat (Site 3)	650702N1472733W	400	31927	NASA
2025-2100	AL, Huntsville	344039N863645W	375	43940	Air Force
2025-2100	AL, Huntsville	344043N0863700W	375	43893	Air Force
2025-2100	AL, Redstone Arsenal	344043N0863700W	375	44838	Army
2025-2100	Antarctica, McMurdo	775021S1664001E	1000	31927	NASA
2025-2100	CA, Berkeley	375248N1221438W	1000	31668	NASA
2025-2100	CA, Goldstone	352030N1165225W	700	20086	NASA
2025-2100	CA, Goldstone (DSS-14)	352533N1165322W	600	36182	NASA
2025-2100	CA, Goldstone (DSS-24)	352024N1165229W	600	36182	NASA
2025-2100	CA, Goldstone (DSS-27)	351418N1164636W	600	36182	NASA
2025-2100	CA, Huntington Beach	334446N1180200W	1150	42215	Air Force
2025-2100	CA, Monterey	363542N1215229W	1118	42215	Air Force
2025-2100	CA, Pasadena (JPL)	341206N1181027W	646	42268	NASA
2025-2100	CA, San Diego	325013N1170940W	1144	43940	Air Force
2025-2100	CA, Table Mountain	342256N1174056W	1000	30825	NASA
2025-2100	CT, New London	412233N0720602W	900	43893	Air Force
2025-2100	FL, Kennedy Uplink	283234N0803837W	1200	41547	NASA
2025-2100	FL, Kennedy Space Center (RFTS)	283507N0803855W	1200	44286	NASA
2025-2100	FL, Melbourne	280136N0803618W	1200	43940	Air Force
2025-2100	FL, Melbourne	280538N0804158W	1118	42215	Air Force
2025-2100	FL, Merritt Island	283030N0804137W	999	20086	NASA
2025-2100	FL, New Smyrna Beach	290300N0805300W	1375	30382 28561	NASA
2025-2100	FL, Palm Bay	280132N0804105W	1147	43893	Air Force
2025-2100	FL, Ponce de Leon (PDL)	290400N0805447W	1200	41547	NASA
2025-2100	FL, St. Petersburg	275230N0823853W	995	42268	Air Force

TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
2025-2110	AK, Fairbanks (FBKS-A)	645825N1473043W	511	45320	Air Force
2025-2110	AK, Fairbanks (FBKS-B)	645824N1473030W	511	45320	Air Force
2025-2110	AK, Fairbanks (FBKS-C)	645823N1473016W	511	45320	Air Force
2025-2110	AK, North Pole West (AS4)	644737N1473218W	517	45320	NASA
2025-2110	CA, Long Beach	334927N1180847W	1200	45320	NASA
2025-2110	CA, Santa Clara	372102N1215603W	887	45320	NASA
2025-2110	FL, Tampa	280329N0822603W	1200	45300	Air Force
2025-2110	GA, Pendergrass	341048N0834012W	375	45300	Air Force
2025-2110	Guam, GRGT	133655N1445122E	1350	30038	NASA
2025-2110	HI, Kauai	215809N1592351W	1200	45320	NASA
2025-2110	HI, Naalehu	190050N1553947W	1200	44285	Air Force
2025-2110	HI, Naalehu	190049N1553946W	1200	44285	Air Force
2025-2110	HI, Oahu	211757N1574858W	1180	42215	Air Force
2025-2110	HI, Paumalu (KSAT)	214012N1580201W	1200	45300	Air Force
2025-2110	KY, Morehead	381130N0832620W	500	41045	NASA
2025-2110	MD, Annapolis	385906N0762906W	900	43893	Air Force
2025-2110	MD, Blossom Point	382550N0770512W	900	42215	Air Force
2025-2110	MD, Blossom Point	382553N0770516W	1000	32075	NASA
2025-2110	MD, Blossom Point (12W)	382544N0770502W	900	35933	NASA
2025-2110	MD, Blossom Point (41W)	382544N0770502W	900	35933	NASA
2025-2110	MD, Blossom Point (62W)	382544N0770502W	900	35933	NASA
2025-2110	MD, Blossom Point (46W)	382544N0770502W	900	41198	NASA
2025-2110	MD, Blossom Point (49W)	382544N0770502W	893	41198	NASA
2025-2110	MD, Blossom Point (62W)	382544N0770502W	858	41198	NASA
2025-2110	MD, Greenbelt	385955N0765034W	700	20086	NASA
2025-2110	MD, Laurel	391100N0765400W	1100	30536	NASA
2025-2110	MD, Laurel	391003N0765356W	912	36438	Navy
2025-2110	MD, Pomonkey	382548N0770512W	1001	28562	Navy
2025-2110	MO, St. Louis	383809N0901338W	428	45320	NASA
2025-2110	NM, Albuquerque	350314N1063710W	375	42215	Air Force
2025-2110	NM, Kirtland AFB	345701N1063027W	375	45300	Air Force
2025-2110	NM, Kirtland AFB	345939N1063028W	428	40419	Air Force
2025-2110	NM, Los Alamos	355218N1061941W	375	37391	Energy
2025-2110	NM, Los Alamos (LANL SOC)	355220N1061939W	375	42268	Air Force
2025-2110	NM, Los Alamos (LANL TA-33)	354618N1061508W	375	42268	Air Force
2025-2110	NM, Sandia National Laboratories	350209N1065407W	1200	45300	Air Force
2025-2110	NM, White Sands (112W)	323224N1063636W	375	43940	NASA
2025-2110	NM, White Sands (112W)	323228N1063644W	375	44838	NASA
2025-2110	NM, White Sands (STGT)	323240N1063648W	375	30038	NASA
2025-2110	NM, White Sands (WSGT)	322954N1063631W	375	37751 30038	NASA
2025-2110	OH, Dayton	394655N0840456W	454	42215	Air Force
2025-2110	OH, Cleveland	412450N0815153W	500	40420	NASA
2025-2110	OH, Cleveland	412450N0815153W	1770	40420	NASA
2025-2110	OH, Cleveland	412450N0815153W	1667	40420	NASA
2025-2110	OH, Kileville	400601N0831152W	460	44285	NASA
2025-2110	OR, Boardman	455117N1193755W	455	44285	NASA



TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
2025-2110	SC, Columbia	345443N804820W	464	43940	Air Force
2025-2110	SD, Sioux Falls	434410N0963721W	360	39549	NASA
2025-2110	TX, Bryan (TAM)	303835N0962821W	461	44286	Air Force
2025-2110	TX, College Station	303716N0962025W	461	42215	Air Force
2025-2110	TX, Houston	293340N0950533W	1200	41547	NASA
2025-2110	UT, Logan	414547N1114920W	375	43893	Air Force
2025-2110	UT, Logan	414539N1114910W	375	42215	Air Force
2025-2110	VA, Quantico	382952N0772223W	995	29147	Navy
2025-2110	VA, Virginia Beach	364616N0755753W	989	42268	Air Force
2025-2110	VA, Wallops Island	375538N0752831W	1000	27266	NASA
2025-2110	VA, Wallops Island	375530N0752835W	1202	37751 34188 31927	NASA
2025-2110	VA, Wallops Island (Site 2)	375523N0752839W	1000	37751 31927	NASA
2025-2110	VA, Wallops Island (WG5 Antenna)	375535N752832W	1200	44285	NASA
2025-2110	VA, Wallops Island (WCDA-A)	375650N0752750W	1200	45320	NASA
2025-2110	VA, Wallops Island (WCDA-B)	375651N0752743W	1200	45320	NASA
2025-2120	AK, Fairbanks	645826N1473035W	370	39549	Commerce
2025-2120	CA, Goldstone (DSS-16)	352030N1165222W	1000	29585	NASA
2025-2120	CA, Goldstone (DSS-24)	352024N1165229W	1000	29585	NASA
2025-2120	CA, Goldstone (DSS-27)	351418N1164644W	925	29585	NASA
2025-2120	Ontario, Shirley Bay	452056N0755323W	520	SPS-893	Canada
2026.495- 2036.75	WV, Fairmont (60W)	392601N801136W	445	44284	Commerce
2026.495- 2036.75	WV, Fairmont (75W)	392601N801136W	445	44284	Commerce
2026.495- 2036.75	WV, Fairmont (89.5W)	392601N801136W	445	44284	Commerce
2026.495- 2036.75	WV, Fairmont (105W)	392601N801136W	445	44284	Commerce
2026.495- 2036.75	WV, Fairmont (137W)	392601N801136W	445	44284	Commerce
2026.495- 2036.75	VA, Wallops Island (60W)	375645N752744W	1196	44284	Commerce
2026.495- 2036.75	VA, Wallops Island (75W)	375645N752744W	1190	44284	Commerce
2026.495- 2036.75	VA, Wallops Island (89.5W)	375645N752744W	1186	44284	Commerce
2026.495- 2036.75	VA, Wallops Island (105W)	375645N752744W	1186	44284	Commerce
2026.495- 2036.75	VA, Wallops Island (137W)	375645N752744W	1186	44284	Commerce
2036.3	HI, Hawaii N.P.	192524N1551727W	675	36537	Commerce
2036.3	HI, Ahua Kilauea	192256N1551608W	760	36537	Commerce
2036.3	HI, Sandhill Kilauea	192345N1551739W	740	36537	Commerce
2039	RMI, Kwajalein	084301N1674301E	975	36536	Air Force
2040-2090	CO, Colorado Springs	385924N1045136W	375	40267	Air Force
2049.243- 2049.755	CA, Camp Parks	374357N1215250W	606	41856	Air Force
2049.243-	Guam	133534N1445039E	849	41856	Air Force

TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
2049.755					
2049.243- 2049.755	Guam	133455N1445034E	849	42268	Air Force
2049.243- 2049.755	HI, Wahiawa	213113N1575953W	1200	41856	Air Force
2049.243- 2049.755	HI, Kaena Point	213405N1581539W	1200	41856	Air Force
2093.068- 2093.132	AK, Fairbanks	645825N1473057W	375	42116	Commerce
2093.068- 2093.132	VA, Wallops Island	375643N752742W	1163	42116	Commerce
2097-2098	UT, Logan	414539N1114910W	375	45300	Air Force
2109.75	CO, Colorado Springs	385924N1045136W	375	43940	Air Force
2110-2120	HI, Kauai	220700N1594016W	1207	10782	NASA
2200-2285	FL, St. Petersburg	275230N0823853W	1200	42268	Air Force
2200-2285	NM, Los Alamos (LANL SOC)	355220N1061939W	375	42268	Air Force
2200-2285	NM, Los Alamos (LANL TA-33)	354618N1061508W	375	42268	Air Force
2200-2285	VA, Virginia Beach	364616N0755753W	1200	42268	Air Force
2200-2290	AZ, Scottsdale	332735N1115435W	350	29148	NASA
2200-2290	OH, Cleveland (41 W)	412450N0815153W	1667	40420	NASA
2200-2290	TX, Houston	293340N0950533W	950	35933	NASA
2200-2290	TX, Houston (41W)	293340N0950533W	800	35933	NASA
2200-2290	TX, Houston (171W)	293340N0950533W	645	35933	NASA
2285-2290	Guam, Finegayan	133519N1445027E	700	39133	NASA
5925-6425	Nova Scotia, Mill Village	441119N0644012W	805	11804	Canada
5925-6425	Quebec, Bouchette	461318N0755230W	451	11804	Canada
7145-7190	CA, Goldstone (DSS-15)	352519N1165311W	1000	29979 29819	NASA
7145-7190	CA, Goldstone (DSS-25)	352016N1165231W	1000	29653 29979	NASA
7145-7190	CA, Goldstone (DSS-26)	352009N1165223W	1000	30825	NASA
7145-7190	CA, Goldstone (Deep Space)	352519N1165311W	1123	28298	NASA
7145-7235	CA, Goldstone (DSS-24)	352024N1165229W	1000	32866 33192	NASA
7145-7235	CA, Goldstone (DSS-25)	352015N1165231W	1000	32866 33192	NASA
7145-7235	CA, Goldstone (DSS-26)	352008N1165223W	1000	32866 33192	NASA
7145-7235	CA, Goldstone (DSS-14)	352533N1165319W	435	36470	NASA
7145-7235	CA, Goldstone (DSS-26)	352008N1165223W	1050	39549	NASA
7190-7235	AK, Fairbanks	645131N1475127W	528	45320	NASA
7190-7235	CA, Goldstone (DSS-13)	351450N1164738W	875	29584	NASA
7190-7235	CA, Goldstone (DSS-23)	352024N1165220W	1025	37751 29584	NASA
7190-7235	CA, Pasadena (JPL)	341206N1181027W	453	41855	NASA
7190-7235	HI, South Point	190050N1553947W	1071	45300	NASA
7190-7235	HI, South Point	190051N1553948W	1101	45320	NASA
7190-7235	KY, Morehead	381131N0832620W	498	43334	NASA
7211.15- 7222.05	WV, Fairmont (60W)	392601N801136W	176	44284	Commerce

TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
7211.15- 7222.05	WV, Fairmont (75W)	392601N801136W	176	44284	Commerce
7211.15- 7222.05	WV, Fairmont (89.5W)	392601N801136W	176	44284	Commerce
7211.15- 7222.05	WV, Fairmont (105W)	392601N801136W	176	44284	Commerce
7211.15- 7222.05	WV, Fairmont (137W)	392601N801136W	176	44284	Commerce
7211.15- 7222.05	VA, Wallops Island (60W)	375645N752744W	247	44284	Commerce
7211.15- 7222.05	VA, Wallops Island (75W)	375645N752744W	239	44284	Commerce
7211.15- 7222.05	VA, Wallops Island (89.5W)	375645N752744W	239	44284	Commerce
7211.15- 7222.05	VA, Wallops Island (105W)	375645N752744W	246	44284	Commerce
7211.15- 7222.05	VA, Wallops Island (137W)	375645N752744W	263	44284	Commerce
7900-8400	AK, Clear AFS	641728N1491137W	360	45300	Air Force
7900-8400	CO, Schriever (DSCS 3 W-ATL)	384754N1043128W	822	27569	Air Force
7900-8400	GA, Duluth	335743N0840547W	306	44838	Air Force
7900-8400	HI, Kunia	212847N1580316W	1372	27197	Army
7900-8400	IL, Scott AFB	383207N0895106W	369	27198	Air Force
7900-8400	MA, Hanscom AFB	422729N0715584W	870	45320	Air Force
7900-8400	MA, Hanscom AFB	422729N0711627W	600	44285	Air Force
7900-8400	MD, Andrews AFB	384850N0765320W	150	37802	Air Force
7900-8400	MD Blossom Point	384301N0770859W	280	37993	Navy
7900-8400	NC, Rosman	351207N0825220W	153	27991	Army
7900-8400	NM, Kirtland AFB	350300N1062400W	228	30397	Air Force
7900-7975, 8025-8400	AK, Eareckson AFB	624342N1740539E	250	19807	Air Force
7900-7975, 8025-8400	AK, Elmendorf	611513N1494730W	200	19808	Air Force
7900-7975, 8025-8400	CA, Camp Roberts	354403N1204513W	225	19697	Army
7900-7975, 8025-8400	CA, Onizuka (Sunnyvale) AFS	372423N1220133W	175	19811/17378	Air Force
7900-7975, 8025-8400	GA, Fort Gordon	332520N0821058W	200	19759	Army
7900-7975, 8025-8400	Guam, Finegayan	133555N1445050E	300	19812	Navy
7900-7975, 8025-8400	HI, Wahiawa	212529N1580546W	225	19739	Navy
7900-7975, 8025-8400	MD, Brandywine	384040N0765042W	349	12997	Air Force
7900-7975, 8025-8400	MD, Fort Detrick	392636N0772453W	249	19698 19480 16632	Army
7900-7975, 8025-8400	NE, Offutt AFB	410809N0955454W	110	19527	Air Force
7900-7975, 8025-8400	NH, Manchester	425600N0713800W	200	19526	Air Force
7900-7975,	Ontario, Carp	452100N0760310W	412	15524	Canada

TRANSMITTING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
8025-8400					
7900-7975, 8025-8400	VA, Northwest	363329N0761503W	475	19893	Navy
7900-7975, 8025-8400	CA, Camp Parks	374358N1215241W	1015	28443	Air Force
7900-7975, 8025-8400	CA, Camp Roberts	354403N1204513W	1013	28252	Army
7900-7975, 8025-8400	CO, Buckley ANGB	394255N1044629W	481	28252	Air Force
7900-7975, 8025-8400	GA, Fort Gordon	332520N0821058W	1004	28252	Army
7900-7975, 8025-8400	MA, Cape Cod AFS	414511N0703218W	1009	28252	Air Force
7900-7975, 8025-8400	MD, Fort Detrick	392636N0772453W	1030	28252	Army
7900-7975, 8025-8400	NJ, Fort Monmouth	401901N0740206W	1016	28252	Army
7900-7975, 8025-8400	PR, Cabre de Tierra	181300N0653700W	350	20042	Navy
7900-7975, 8025-8400	TX, Lackland AFB	292230N0983730W	1139	28252	Air Force
7900-7975, 8025-8400	VA, Northwest	363336N0761503W	972	28298	Navy
14600-15225	MD, Blossom Point (12W)	382544N0770502W	230	35933	NASA
14600-15225	MD, Blossom Point (41W)	382544N0770502W	152	35933	NASA
14600-15225	MD, Blossom Point (46 W)	382544N0770502W	101	41198	NASA
14600-15225	MD, Blossom Point (49 W)	382544N0770502W	101	41198	NASA
14600-15225	MD, Blossom Point (62 W)	382544N0770502W	101	41198	NASA
34200-34700	CA, Goldstone (DSS-25)	352015N1165231W	185	SPS-12658	NASA
* The nominal coordination distance shown is the maximum coordination distance derived from the coordination contour.					

RECEIVING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
1670-1690	MA, Hanscom Field	422800N0712800W	177	19251	Air Force
1670-1710	AK, Fairbanks	645835N1473119W	399	29584	Commerce
1670-1710	CO, Boulder	400750N1051422W	100	17183	Commerce
1670-1710	HI, Honolulu	212112N1575236W	100	17183	Commerce
1670-1710	MD, Greenbelt	390002N0765029W	975	29339	NASA
1670-1710	MD, Suitland	385106N0765554W	160	16761	Commerce
1670-1710	VA, Wallops Island	375644N0752742W	160	16761	Commerce
1670-1710	VA, Wallops Island	375734N0752817W	882	29584	Commerce
1670-1710	WA, Seattle	473415N1223310W	405	17183	Commerce
1679.7- 1694.705	WV, Fairmont (60W)	392601N801136W	553	44284	Commerce
1679.7- 1694.705	WV, Fairmont (75W)	392601N801136W	552	44284	Commerce
1679.7- 1694.705	WV, Fairmont (89.5W)	392601N801136W	552	44284	Commerce
1679.7- 1694.705	WV, Fairmont (105W)	392601N801136W	552	44284	Commerce
1679.7- 1694.705	WV, Fairmont (137W)	392601N801136W	552	44284	Commerce
1695-1710	AK, Fairbanks	645824N1473050W	474	45300	Commerce
1695-1710	CA, Monterrey	363530N1215113W	1200	45300	Commerce
1695-1710	FL, Miami	254404N0800943W	1200	45300	Commerce
1695-1710	GU, Barrigada	132841N1444740E	1200	45300	Commerce
1695-1710	HI, Ford Island	212157N1575746W	1200	45300	Commerce
1695-1710	HI, Honolulu	211919N1575215W	1200	45300	Commerce
1695-1710	PTR, Mayaguez	181241N0670813W	1200	45300	Commerce
1695-1710	WI, Madison	430421N0892441W	582	45300	Commerce
2025-2110	VA, Virginia Beach	364616N0755753W	989	42268	Air Force
2103.4-2109.4	Guam, Finegayan	133519N1445027E	1225	39133	NASA
2200-2290	AK, Barrow Point	711800N1563600W	900	39549	Commerce
2200-2290	AK, Elmendorf AFB	611739N1494622W	498	44285	Air Force
2200-2290	AK, Fairbanks	644739N1473213W	460	43893	Air Force
2200-2290	AK, Fairbanks	645123N1474917W	460	42215	Air Force
2200-2290	AK, Fairbanks	645826N1473021W	397	44838	Commerce
2200-2290	AK, Fairbanks	645838N1473054W	1600	20086	NASA
2200-2290	AK, Fairbanks	645131N1475127W	523	34188	NASA
2200-2290	AK, Fairbanks	645833N1473119W	399	29584	Commerce
2200-2290	AK, Fairbanks	645826N1473035W	370	39549	Commerce
2200-2290	AK, Fairbanks (FBKS-A)	645825N1473043W	498	45320	Air Force
2200-2290	AK, Fairbanks (FBKS-B)	645824N1473030W	498	45320	Air Force
2200-2290	AK, Fairbanks (FBKS-C)	645823N1473016W	498	45320	Air Force
2200-2290	AK, Gilmore Creek	645826N1473007W	1375	39549	Commerce
2200-2290	AK, Gilmore Creek	645824N1473029W	396	42268	Commerce
2200-2290	AK, North Pole	644816N1473001W	489	44285	Air Force
2200-2290	AK, North Pole	644818N1473000W	400	30976	NASA
2200-2290	AK, North Pole	644800N1473000W	272	35566	NASA
2200-2290	AK, Poker Flat	650600N1470300W	440	28862	NASA
2200-2290	AK, Poker Flat	650825N1473042W	400	29585 29653	NASA
2200-2290	AL, Huntsville	344043N0863700W	375	43893	Air Force
2200-2290	AL, Redstone Arsenal	344043N0863700W	375	44838	Army
2200-2290	CA, Azusa	341259N1175232W	475	33720	Air Force
2200-2290	CA, Azusa	340733N1175538W	1139	41856	Air Force
2200-2290	CA, Berkeley	375248N1221438W	1000	31668	NASA

RECEIVING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/ SPS/FAS DOCUMENT	AGENCY/ COUNTRY
2200-2290	CA, Camp Parks	374400N1215200W	1053	27198	Air Force
2200-2290	CA, Edwards AFB	345729N1175442W	925	28561 29148	NASA
2200-2290	CA, Edward AFB	345729N1175442W	925	28561	NASA
2200-2290	CA, Goldstone (DSS-14)	352533N1165322W	400	36182	NASA
2200-2290	CA, Goldstone (DSS-24)	352024N1165229W	400	36182	NASA
2200-2290	CA, Goldstone (DSS-27)	351418N1164636W	400	36182	NASA
2200-2290	CA, Huntington Beach	334506N1180214W	1076	40419	Air Force
2200-2290	CA, Huntington Beach	334450N1180204W	1200	43337	Air Force
2200-2290	CA, Huntington Beach	334446N1180200W	1200	42215	Air Force
2200-2290	CA, Laguna Peak	340655N1190450W	909	28562	Navy
2200-2290	CA, Long Beach (KSAT)	334924N1180847W	1200	44286	Air Force
2200-2290	CA, McClellan AFB	383959N1212333W	414	40419	Air Force
2200-2290	CA, McClellan AFB	383959N1212333W	424	43337	Air Force
2200-2290	CA, Monterey	363542N1215229W	1200	42215	Air Force
2200-2290	CA, Santa Clara	372102N1215603W	857	45320	Air Force
2200-2290	CA, Table Mountain	342256N1174056W	875	30825	NASA
2200-2290	CA, Vandenberg AFB	344923N1203007W	1200	43333	Air Force
2200-2290	CA, Vandenberg VTS-A	344921N1203007W	1200	43335	Air Force
2200-2290	CA, Vandenberg VTS-B	344932N1203019W	1200	43335	Air Force
2200-2290	CA, Vandenberg AFB	344327N1203224W	1165	38574	Air Force
2200-2290	CT, New London	412233N0720602W	900	43893	Air Force
2200-2290	CO, Boulder	400357N1051217W	375	45300	Air Force
2200-2290	CO, Greeley ANG	402525N1043820W	375	45300	Air Force
2200-2290	CO, Peterson AFB	384834N1044036W	375	45300	Air Force
2200-2290	CO, Schriever AFB (Formerly Falcon AFB)	384754N1043128W	423	30274	Air Force
2200-2290	FL, Cape Canaveral	282909N0803430W	905	28443	Air Force
2200-2290	FL, Kennedy Space Center (RFTS)	283507N0803855W	1171	44286	NASA
2200-2290	FL, Key West	243239N0814817W	1000	40419	Air Force
2200-2290	FL, Key West	243236N0814817W	1200	43337	Air Force
2200-2290	FL, Melbourne	280136N0803618W	1200	43940	Air Force
2200-2290	FL, Melbourne	280538N0804158W	1200	42215	Air Force
2200-2290	FL, Merritt Island	282747N0803911W	1200	45300	NASA
2200-2290	FL, Merritt Island	283030N0804137W	3000	20086	NASA
2200-2290	FL, New Smyrna Beach	290300N0805300W	1225	30382	NASA
2200-2290	FL, Palm Bay	280132N0804105W	1200	43893	Air Force
2200-2290	FL, Tampa	280329N0822603W	1200	45300	Air Force
2200-2290	FL, Tequesta (JDMTA)	265858N0800630W	1200	45300	NASA
2200-2290	GA, Atlanta	335747N0840514W	500	36584	Air Force
2200-2290	GA, Duluth	335743N0840547W	495	44838	Air Force
2200-2290	GA, Pendergrass	341048N0834012W	375	45300	Air Force
2200-2290	Guam, Anderson AFB	133654N1445122E	1200	43333	Air Force
2200-2290	Guam, Anderson GTS-A	133655N1445122E	1200	43335	Air Force
2200-2290	Guam, Anderson GTS-B	133657N1445130E	1200	43335	Air Force
2200-2290	Guam, Anderson GTS-C	133657N1445120E	1200	43335	Air Force
2200-2290	Guam, GRGT	133655N1445122E	1300	30038	NASA
2200-2290	Guam, NCTAMS WESTPAC	133455N1445050E	1207	28562	Navy
2200-2290	HI, Haleiwa	214007N1580159W	1200	43940	Air Force
2200-2290	HI, Kaena Point	213343N1581431W	1200	43333	Air Force
2200-2290	HI, Kaena PA HTS-A	213342N1581426W	1200	43335	Air Force
2200-2290	HI, Kaena PA HTS-B	213408N1581544W	1200	43335	Air Force

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2200-2290	HI, Kauai	215809N1592351W	1200	45320	NASA
2200-2290	HI, Naalehu	190050N1553947W	1200	44285	Air Force
2200-2290	HI, Naalehu	190049N1553946W	1200	44285	Air Force
2200-2290	HI, Oahu	211757N1574858W	1200	42215	Air Force
2200-2290	HI, Paumalu (KSAT)	214012N1580201W	1200	45300	Air Force
2200-2290	HI, South Point	190048N1553947W	1225	30976	NASA
2200-2290	IN, Butlerville	390258N0853136W	470	43940	Air Force
2200-2290	KY, Morehead	381130N0832620W	471	41045	NASA
2200-2290	MD, Annapolis	385906N0762906W	900	43893	Air Force
2200-2290	MD, Blossom Point	382550N0770512W	900	42215	Air Force
2200-2290	MD, Blossom Point	382553N0770516W	900	32075	NASA
2200-2290	MD, Blossom Point	382553N0770509W	900	45320	Air Force
2200-2290	MD, Blossom Point (12W)	382544N0770502W	900	37751/35933	NASA
2200-2290	MD, Blossom Point (41W)	382544N0770502W	900	37751/35933	NASA
2200-2290	MD, Blossom Point (62W)	382544N0770502W	900	37751/35933	NASA
2200-2290	MD, Blossom Point (46 W)	382544N0770502W	751	41198	NASA
2200-2290	MD, Blossom Point (49 W)	382544N0770502W	741	41198	NASA
2200-2290	MD, Blossom Point (62 W)	382544N0770502W	703	41198	NASA
2200-2290	MD, Greenbelt	385955N0765034W	1850	20086	NASA
2200-2290	MD, Laurel	391100N0765400W	925	30536	NASA
2200-2290	MD, Laurel	391003N0765356W	900	36438	Navy
2200-2290	MD, Patuxent River NAS	381628N0762445W	880	40419	Air Force
2200-2290	MD, Patuxent River NAS	381628N0762445W	461	43337	Air Force
2200-2290	MD, Pomonkey	382548N0770512W	898	28562	Navy
2200-2290	ME, Prospect Harbor	442455N0680150W	893	28562	Navy
2200-2290	MO, St. Louis	383809N0901338W	383	45320	NASA
2200-2290	NC, Fort Bragg	350935N0785924W	400	40419	Air Force
2200-2290	NC, Fort Bragg	350904N0785913W	464	43337	Air Force
2200-2290	NH, New Boston	425646N0713744W	700	43333	Air Force
2200-2290	NM, Albuquerque	350314N1063710W	375	42215	Air Force
2200-2290	NH, New Boston NHS-A	425646N0713746W	720	43335	Air Force
2200-2290	NH, New Boston NHS-B	425652N0713736W	720	43335	Air Force
2200-2290	NH, New Boston NHS-C	425641N0713749W	720	43335	Air Force
2200-2290	NM, Kirtland AFB	345701N1063027W	375	45300	Air Force
2200-2290	NM, Kirtland AFB	345939N1063028W	428	40419	Air Force
2200-2290	NM, Kirtland AFB	350300N1062400W	330	30397	Air Force
2200-2290	NM, Los Alamos	355218N1061941W	375	37391	Energy
2200-2290	NM, Sandia National Labs	350209N1065407W	1200	45300	Air Force
2200-2290	NM, White Sands	322249N1062854W	375	45300	Air Force
2200-2290	NM, White Sands (112W)	323224N1063636W	375	43940	NASA
2200-2290	NM, White Sands (112W)	323228N1063644W	375	44838	NASA
2200-2290	NM, White Sands (STGT)	323240N1063648W	375	30038	NASA
2200-2290	NM, White Sands (WSGT)	322954N1063631W	375	30038	NASA
2200-2290	OH, Cleveland	412450N0815153W	1770	40420	NASA
2200-2290	OH, Cleveland	412450N0815153W	810	40420	NASA
2200-2290	OH, Cleveland (41W)	412450N0815153W	500	40420	NASA
2200-2290	OH, Cleveland	412450N0815153W	500	40420	NASA
2200-2290	OH, Dayton	394655N0840456W	479	42215	Air Force
2200-2290	OH, Kileville	400601N0831152W	422	44285	NASA
2200-2290	OK, Norman	351048N0973357W	528	27685	Commerce
2200-2290	OR, Boardman	455117N1193755W	417	44285	NASA
2200-2290	Ontario, Shirley Bay	452056N0755323W	575	SPS-893	Canada
2200-2290	PTR, Mayaguez	181242N0670813W	1200	30710	NASA
2200-2290	SD, Sioux Falls	434410N0963721W	360	39549	NASA

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2200-2290	TX, Bryan (TAM)	303835N0962821W	486	44286	Air Force
2200-2290	TX, College Station	303716N0962025W	486	42215	Air Force
2200-2290	TX, Fort Hood	310857N0974612W	425	43337	Air Force
2200-2290	TX, Kelly AFB	294800N0983600W	1193	29873	Air Force
2200-2290	UT, Logan	414547N1114920W	375	43893	Air Force
2200-2290	UT, Logan	414539N1114910W	375	42215	Air Force
2200-2290	VA, Fort Belvoir	384407N0770913W	900	37249	Air Force
2200-2290	VA, Herndon	385751N0772244W	900	43940	Air Force
2200-2290	VA, Quantico	382952N0772223W	1047	29147	Navy
2200-2290	VA, Wallops Island	375538N0752831W	900	27266	NASA
2200-2290	VA, Wallops Island (WG5 Antenna)	375535N752832W	1200	44286	NASA
2200-2290	VA, Wallops Island	375530N0752835W	747	34188	NASA
2200-2290	VA, Wallops Island	375624N0752812W	1200	44838	Commerce
2200-2290	VA, Wallops Island	375734N0752817W	882	29584	Commerce
2200-2290	VA, Wallops Island (WCDA-A)	375650N0752750W	1200	45320	Air Force
2200-2290	VA, Wallops Island (WCDA-A)	375651N0752743W	1200	45320	Air Force
2200-2290	WA, Lewis-McChord	470557N1223331W	414	40419	Air Force
2200-2290	WA, Lewis-McChord	470611N1223311W	491	43337	Air Force
2200-2290	AK, North Pole West (AS4)	644737N1473218W	427	45320	NASA
2200-2300	AK, Eareckson AFB	5243XXN017407E	409	SPS-2916	Air Force
2200-2300	CA, Goldstone (DSS-24)	352024N1165229W	925	29585	NASA
2200-2300	CA, Goldstone (DSS-27)	351418N1164644W	925	29585	NASA
2200-2300	CA, Vandenberg AFB	342924N1203154W	700	20037	Air Force
2200-2300	CO, Buckley AFB	3943XXN10446XXW	589	SPS-2916	Air Force
2200-2300	FL, Cape Kennedy	2824XXN08030XXW	589	SPS-2916	Air Force
2200-2300	FL, Kennedy Uplink Station (KUS)	283234N0803837W	1200	41547	NASA
2200-2300	FL, Ponce de Leon (PDL)	290400N0805447W	1200	41547	NASA
2200-2300	Guam, Andersen AFB	133648N1445112W	1300	20037	Air Force
2200-2300	HI, Kaena Point	213418N1581634W	1350	20037	Air Force
2200-2300	MD, Blossom Point	382553N0770516W	900	29819	Navy
2200-2300	ME, Loring AFB	4700XXN06801XXW	568	SPS-2916	Air Force
2200-2300	NH, New Boston	425654N0713824W	700	20037	Air Force
2200-2300	TX, Houston	293340N0950533W	1200	41547	NASA
2200-2300	VA, Quantico	382952N0772223W	903	29819	Navy
2200-2300	WA, Fairchild AFB	4730XXN11810XXW	568	SPS-2916	Air Force
2208.575-2213.505	WV, Fairmont (60W)	392601N801136W	375	44284	Commerce
2208.575-2213.505	WV, Fairmont (75W)	392601N801136W	375	44284	Commerce
2208.575-2213.505	WV, Fairmont (89.5W)	392601N801136W	375	44284	Commerce
2208.575-2213.505	WV, Fairmont (105W)	392601N801136W	375	44284	Commerce
2208.575-2213.505	WV, Fairmont (137W)	392601N801136W	375	44284	Commerce
2224.650-2226.750	Guam	133533N1445039E	839	41856	Air Force
2224.650-2226.750	Guam	133455N1445034E	839	42268	Air Force
2224.650-	HI, Wahiawa	213 1 13N1575953W	1200	41856	Air Force



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2226.750					
2224.650- 2226.750	HI, Kaena Point	213405N1581539W	1200	41856	Air Force
2227.500	FL, Cape GA CCAFB	282903N0803421W	1200	43336	Air Force
2227.5	RMI, Kwajalein Island	084323N1674353E	1200	44285	Air Force
2237.500	CA, Redondo Beach	335351N1182225W	1200	41856	Air Force
2240-2290	CO, Colorado Springs	385924N1045136W	375	41546	Air Force
2262-2266	Guam	133537N144553 JE	1200	42116	Commerce
2262-2266	HI, Hickam AFB	211918N1575730W	1200	42116	Commerce
2275-2276	UT, Logan	414539N1114910W	375	45300	Air Force
2290-2300	CA, Goldstone	352529N1165324W	1800	19906	NASA
2290-2300	CA, Goldstone (DSS-14)	352533N1165319W	650	37751	NASA
3700-4200	Nova Scotia, Mill Village	441119N0644012W	756	11804	Canada
3700-4200	Quebec, Bouchette	461318N0755230W	475	11804	Canada
7250-7300	NC, Fort Bragg	351000N0790100W	823	26516	Army
7250-7300	VA, Fort Belvoir	384337N0770853W	1042	26971	Army
7250-7750	AK, Ft. Greely	635848N1454312W	376	40643	Army
7250-7750	CA, Vandenberg AFB (52.5W)	344405N1203251W	460	36889	Air Force
7250-7750	CA, Vandenberg AFB (135W)	344405N1203251W	460	36889	Air Force
7250-7750	CA, Vandenberg AFB (52.5W)	344406N1203253W	460	36889	Air Force
7250-7750	CA, Vandenberg AFB (135W)	344406N1203253W	460	36889	Air Force
7250-7750	CO, Colorado Springs	384834N1044036W	375	43940	Air Force
7250-7750	CO, Schriever (DSCS 3 E-PAC)	384754N1043128W	1344	27569	Air Force
7250-7750	CO, Schriever (DSCS 3 W-ATL)	384754N1043128W	453	27569	Air Force
7250-7750	GA, Duluth	335743N0840547W	345	44838	Air Force
7250-7750	HI, Kunia	212847N1580316W	1392	27197	Army
7250-7750	IL, Scott AFB	383207N0895106W	438	27198	Air Force
7250-7750	MA, Hanscom AFB	422729N711627W	600	44286	Air Force
7250-7750	MA, Hanscom AFB	071W155842N2729	870	45320	Air Force
7250-7750	MD, Andrews AFB	384850N0765320W	830	37802	Air Force
7250-7750	MD, Blossom Point	384301N0770859W	820	37993	Navy
7250-7750	NC, Rosman	350245N0825233W	541	27991	Army
7250-7750	NM, Kirtland AFB	350300N1062400W	400	30397	Air Force
7250-7750	AK, Clear AFS	641728N1491137W	373	45300	Air Force
7300-7750	AK, Clear AFS	642039N1491113W	465	28252	Air Force
7300-7750	AK, Eareckson AFB	524342N1740539E	500	19807	Air Force
7300-7750	AK, Elmendorf	611513N1494730W	575	19808	Air Force
7300-7750	CA, Beale AFB	390815N1212647W	1042	28252	Air Force
7300-7750	CA, Camp Parks	374358N1215241W	1054	28443	Air Force
7300-7750	CA, Camp Roberts	354403N1204513W	1025	28252	Army
7300-7750	CA, Camp Roberts	354403N1204513W	400	19697	Army
7300-7750	CA, Onizuka (Sunnyvale) AFS	372423N1220133W	375	19811/17378	Air Force
7300-7750	CO, Buckley ANGB	394255N1044629W	483	28252	Air Force
7300-7750	CO, Peterson AFB	384831N1044235W	454	28252	Air Force
7300-7750	GA, Fort Gordon	332520N0821058W	1051	28252	Army
7300-7750	GA, Fort Gordon	332520N0821058W	650	19759	Army
7300-7750	GA, Robins AFB	323819N0833631W	620	28252	Air Force

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7300-7750	Guam, Finegayan	133455N1445050E	575	19812	Navy
7300-7750	HI, Hickam AFB	211939N1575652W	1357	28252	Air Force
7300-7750	HI, Hilo	194300N1550328W	1500	28252	Air Force
7300-7750	HI, Wahiawa	212529N1580546W	775	19739	Navy
7300-7750	MA, Cape Cod AFS	414511N0703218W	1046	28252	Air Force
7300-7750	MD, Brandywine	384040N0765042W	169	12997	Air Force
7300-7750	MD, Fort Detrick	392636N0772453W	1045	28252	Army
7300-7750	MD, Fort Detrick	392636N0772453W	700	19698 19480 16632	Army
7300-7750	MD, Fort Meade	390614N0764526W	1102	28252	Army
7300-7750	MD, Fort Ritchie	394225N0772915W	490	28252	Army
7300-7750	ND, Cavalier AFS	484331N0975356W	403	28252	Air Force
7300-7750	NE, Offutt AFB	410809N0955454W	475	19527	Air Force
7300-7750	NH, Manchester	425600N0713800W	550	19526	Air Force
7300-7750	Ontario, Carp	452100N0760310W	550	15524	Canada
7300-7750	PR, Cabre de Tierra	1813XXN06537W	750	20042	Navy
7300-7750	TX, Eldorado AFS	311030N1003308W	470	28252	Air Force
7300-7750	TX, Lackland AFB	292230N0983730W	1117	28252	Air Force
7300-7750	VA, Northwest	364903N0763216W	650	19893	Navy
7300-7750	VA, Northwest	363336N0761503W	1051	28298	Navy
7900-8400	MA, Hanscom AFB	071W155842N2729	870	45320	Air Force
8025-8175	AK, Fairbanks	645826N1473021W	375	44838	Commerce
8025-8400	AK, Anchorage	610924N1495907W	821	40643	NASA
8025-8400	AK, North Pole	644818N1473000W	468	40643	NASA
8025-8400	AK, North Pole West (AS4)	644737N1473218W	469	45320	NASA
8025-8400	AK, Poker Flat	650700N1472735W	375	40643	NASA
8025-8400	AK, Fairbanks (U of AK)	645137N1475050W	385	28561	NASA
8025-8400	AK, Gilmore Creek	645826N1473007W	1375	39549	Commerce
8025-8400	AL, Huntsville	344039N863645W	375	43940	Air Force
8025-8400	CA, La Jolla	325211N1171507W	945	40643	NASA
8025-8400	CA, Long Beach (KSAT)	334924N1180847W	784	44286	Air Force
8025-8400	CA, Poway	325618N1170242W	741	40643	NASA
8025-8400	CA, San Diego	325013N1170940W	1144	43940	Air Force
8025-8400	FL, St. Petersburg	274536N0823755W	954	40643	NASA
8025-8400	HI, Honolulu	211754N1574859W	969	40643	NASA
8025-8400	HI, Kauai	215809N1592351W	913	45320	NASA
8025-8400	HI, Nelha	190111N1554532W	875	30900	NASA
8025-8400	HI, South Point	190050N1553947W	984	45300	NASA
8025-8400	MD, Greenbelt	385957N0765118W	900	40643	NASA
8025-8400	PA, Horsham	401210N0751028W	725	30900	NASA
8025-8400	SC, Columbia	345443N804820W	472	43940	Air Force
8025-8400	SD, Sioux Falls	434410N0963721W	360	39549	NASA
8025-8400	VA, Wallops Island	375528N0752835W	4000	40420	NASA
8025-8400	VA, Wallops Island (WG5 Antenna)	375535N752832W	1017	44286	NASA
8025-8400	WI, Madison	430415N0892424W	463	40643	NASA
8160-8280	WV, Fairmont (60W)	392601N801136W	330	44284	Commerce
8160-8280	WV, Fairmont (75W)	392601N801136W	330	44284	Commerce
8160-8280	WV, Fairmont (89.5W)	392601N801136W	330	44284	Commerce
8160-8280	WV, Fairmont (105W)	392601N801136W	330	44284	Commerce
8160-8280	WV, Fairmont (137W)	392601N801136W	330	44284	Commerce
8160-8280	VA, Wallops Island (60W)	375645N752744W	582	44284	Commerce

RECEIVING EARTH STATIONS					
BAND (MHz)	LOCATION	COORDINATES	NOMINAL COORDINATION DISTANCE* (KILOMETERS)	IRAC/SPS/FAS DOCUMENT	AGENCY/COUNTRY
8160-8280	VA, Wallops Island (75W)	375645N752744W	575	44284	Commerce
8160-8280	VA, Wallops Island (89.5W)	375645N752744W	575	44284	Commerce
8160-8280	VA, Wallops Island (105W)	375645N752744W	575	44284	Commerce
8160-8280	VA, Wallops Island (137W)	375645N752744W	575	44284	Commerce
8400-8450	HI, South Point	190050N1553947W	1200	45300	NASA
8400-8450	VA, Wallops Island (WG5 Antenna)	375535N752832W	1200	44286	NASA
8450-8500	AK, Fairbanks	645131N1475127W	538	45320	NASA
8450-8500	AK, Fairbanks (ASF-10)	645135N1475050W	1875	40420	NASA
8450-8500	AK, Fairbanks (ASF-11)	645131N1475118W	1875	40420	NASA
8450-8500	AK, North Pole West (AS4)	644737N1473218W	517	45320	NASA
8450-8500	CA, Goldstone (DSS-13)	351450N1164738W	975	29584	NASA
8450-8500	CA, Goldstone (DSS-26)	352008N1165223W	1155	39549	NASA
8450-8500	CA, Goldstone (DSS-26)	352008N1165223W	464	39549	NASA
8450-8500	HI, South Point	190050N1553947W	1182	45300	NASA
8450-8500	HI, South Point	190051N1553948W	1175	45320	NASA
8450-8500	KY, Morehead	381131N0832620W	500	43334	NASA
8450-8500	VA, Wallops Island	375528N0752835W	4000	40420	NASA
8450-8500	VA, Wallops Island (WG5 Antenna)	375535N752832W	1200	44286	NASA
8475	AK, North Pole	644816N1473001W	514	44285	Air Force
8475	HI, Naalehu	190050N1553947W	1200	44285	Air Force
8475	HI, Naalehu	190049N1553946W	1200	44285	Air Force
25500-27000	AK, North Pole West (AS4)	644737N1473218W	210	45320	NASA
25500-27000	NM, White Sands	323002N1063616W	80	37751/33721	NASA
25500-27000	VA, Wallops Island (WG5 Antenna)	375535N752832W	263	44286	NASA
26703.4	AK, Gilmore Creek	645823N1473022W	100	42268	DOC
31800-32300	CA, Goldstone (DSS-13)	351450N1164740W	200	32075	NASA
31800-32300	CA, Goldstone (DSS-25)	352015N1165231W	185	SPS-12658	NASA

\* The nominal coordination distance shown is the maximum coordination distance derived from the coordination contour.

### 8.3.16 Coordination Procedures for the Use of the Frequencies 1030 and 1090 MHz and Frequencies in the Bands 1215-1390, 2700-2900 and 9000-9200 MHz

1. Applicability--The following coordination procedures provide for the local selection of frequencies and minimize the possibility of harmful interference. These procedures are applicable for all frequency assignment actions for use by U.S. Federal Government radio stations within the US&P for the purposes indicated:

1030 MHz  
1090 MHz  
1215-1390 MHz--Radars  
2700-2900 MHz--Radars  
9000-9200 MHz--Radars

These procedures provide for coordination and selection of frequencies minimizing the possibility of harmful interference.

2. Coordination Procedures--The FAA, as the National Airspace System (NAS) manager and having primary responsibility for flight safety, has established a web-based frequency coordination request portal (See Annex D). This portal should be used for the coordination of UNCLASSIFIED frequency requests used for control of aeronautical operations within the NAS. Annex D provides a more detailed description of the FAA frequency coordination portal.

### 3. Procedures

a. General--All proposed UNCLASSIFIED frequency assignment actions as described above shall be coordinated by the applicant with the FAA via the web portal (See Annex D), or as otherwise prescribed by an FAA representative. The request will be automatically forwarded to the appropriate FAA personnel, who will recommend a frequency and pulse repetition rate (PRR) based on the applicant's requirements and the technical particulars furnished by the applicant. If an interference free frequency or PRR cannot be engineered, the FAA will inform the applicant of such and will recommend alternatives and/or restrictions to preclude such interference problems.

#### b. Interrogators (1030 MHz) and Transponders (1090 MHz)

(1) The concentration of usage for secondary surveillance radar (SSR) (IFF/SIF) systems on a single pair of frequencies, 1030 MHz and 1090 MHz, requires special measures to assure compatibility of operations. Strict control of operational parameters (i.e., power, pulse repetition rate, side lobe suppression, etc.) is necessary to prevent unacceptable degradation to the military mission and flight safety.

(2) Agencies shall cooperate with the FAA in the coordination, selection, and control of critical operational parameters to provide optimum sharing and maximum assurance of compatible operations within the limits of equipment availability and operational requirements. This cooperation shall include timely responses to FAA proposals for changes of PRRs, powers, SLS, etc., which may be required for relief of harmful interference, and submission of a modification or replacement action to the FAS to amend that frequency assignment record.

(3) Accordingly, all federal agencies requiring the use of 1030 MHz for interrogators or 1090 MHz for ground transponders, and either frequency for test equipment that radiate pulsed emissions, shall, prior to filing applications for new and modified requirements, coordinate the planned operational parameters for each new interrogator or ground transponder and every change of each existing interrogator with the FAA.

(4) Shipboard Interrogators--Operational agreements with the FAA are required when operations are within 185 kilometers of the U.S. Coast or its possessions or as modified by local agreement. Further coordination is not required when parameters are within guidelines established by operational agreements.

(5) Land-based Mobile Interrogators--Operational agreements with the FAA are required when an interrogator is to be operated at transient locations, such as during military maneuvers. Further coordination is not required when parameters are within guidelines established by operational agreements.

(6) Airborne Interrogators--FAA coordination is required and operational capabilities and parameters must be established when an interrogator is operated airborne. Further coordination is not required when parameters are within established guidelines.

(7) Airborne Transponders--Since transponders are safety systems, FAA coordination is required prior to transponder operations. Transponders requiring unrestricted operations in the US&P require either FAA Civil Certification or an NTIA Stage 4 Certification to apply for a US&P assignment. These certifications cover specific equipment, software load, airframe, and airframe configurations. Operations of uncertified transponders will be confined to specific restricted airspace(s); however, a temporary US&P assignment is allowed, for operational purposes, while awaiting the DOD AIMS Platform-Level and NTIA Stage 4 Certifications.

#### c. Radars (1215-1390, 2700-2900, 9000-9200 MHz)

(1) The concentration of usage for radar systems requires special measures to assure compatibility of operations. The planning, coordination, and control required to provide separation between frequencies and pulse repetition rates and operations within mutual interference range, are necessary to prevent unacceptable degradation where flight safety and meteorological radars are concerned.

(2) Agencies shall cooperate with the FAA in the coordination, selection, and control of power, frequencies and PRRs to provide optimum sharing and maximum assurance of compatible operations within the limits of equipment availability and operational requirements. This cooperation shall include timely responses to FAA proposals for changes of power, frequencies and PRRs which may be required for relief of harmful interference, and submission of a modification or replacement action to the FAS to amend that frequency assignment record.

(3) Accordingly, all federal agencies requiring the use of 1215-1390, 2700-2900, 9000-9200 MHz for radars and for test equipment that radiate pulsed emissions, shall, prior to filing applications for new and modified requirements, coordinate the planned power, frequencies and PRRs for new radars and every change of existing radars the FAA.

(4) There are certain areas in the U.S. where it is difficult to accommodate additional radars in the 2700-2900 MHz band (see Annex D, Figure 1 and Table 1). Radar systems which comply with RSEC Criteria D, under Section 5.5 of this manual, have the capability of incorporating additional Electromagnetic Compatibility (EMC) provisions to enhance their accommodation in designated heavily used areas or for collocated operation. The FAA and the agency requesting the assignment will assess the requirement for these additional EMC provisions when

coordinating frequency assignments in the 2700-2900 MHz band. Frequency assignments in designated heavily used areas or for collocated operation for radars which comply with RSEC Criteria D and do not have the additional EMC provisions installed, shall bear the Record Note S373 (see Annex A).

(5) Shipboard Radars--Operational agreements with the FAA are required when operations are within 100 Nautical Miles (NM) of the U.S. Coast or its possessions or as modified by local agreement. Further coordination is not required when parameters are within guidelines established by operational agreements.

(6) Land-based Mobile Radars--Operational agreements with the FAA are required when a radar is to be operated at transient locations, such as during military maneuvers. Further coordination is not required when parameters are within guidelines established by operational agreements.

(7) Airborne Radars--Prior national-level coordination is required and operational capabilities and parameters must be established when a radar is operated airborne. Further coordination is not required when parameters are within established guidelines.

4. Applicants shall ensure that the coordination comments of the FAA Regional Coordinator are included on all assignment actions submitted to the FAS. The FAS shall not recommend approval of assignment actions that do not bear the appropriate Coordination Note indicating completion of the coordination required by these procedures (see Annex A and Annex D).

5. The NTIA will inform FAA quarterly of all frequency assignment actions affecting the applicable frequencies and bands and areas specified in these procedures.

6. For classified requests, contact the FAA FAS representative and/or submit to [FAA-Spectrum@faa.gov](mailto:FAA-Spectrum@faa.gov).

### **8.3.17 Procedures for Field Level Coordination, and Coordination with the Aerospace and Flight Test Radio Coordinating Council (AFTRCC), of the Frequency Bands 1435-1525, 2360-2395 and 5091-5150 MHz**

1. Applicability--These procedures are applicable for all frequency assignment actions for use of frequencies in the bands 1435-1525, 2360-2395 and 5091-5150 MHz by U.S. Federal Government radio stations within the Conterminous United States, and are implemented to minimize, through local selection of frequencies and effective coordination, the possibility of harmful interference.

#### **2. Field Level Coordinators.**

a. Non-Federal: The AFTRCC is comprised of representatives of the aerospace manufacturing industry using the federal/non-federal shared 1435-1525, 2360-2395 and 5091-5150 MHz bands during the research and development phases of manned and unmanned aircraft, missiles, booster rockets and other expendable vehicles, or their major components. In 1969 the FCC recognized the AFTRCC as the Frequency Coordinating Advisory Committee for non-federal flight test telemetry station assignments in the band 1435-1525 MHz, and in 2012 extended this recognition to the 2360-2395, and 5091-5150 MHz bands. The AFTRCC Coordinator (point of contact for coordination) is listed in Annex D, Table 3.

b. Federal: The military services, as major users of the radio frequency spectrum during research, development and testing of systems, have established Area Frequency Coordinators (AFCs) that are responsible for coordination of frequency use within designated military ranges or geographical areas of the United States. In 1971<sup>13</sup> the IRAC agreed that certain military AFCs would be the principal federal entities responsible for field level coordination of all U.S. federal use of the band 1435-1525 MHz, and in 2012 extended this procedure to include the 2360-2395 MHz band. Annex D, Table 3 lists these AFCs and indicates their areas of responsibility and Figure 3 is a map depicting those areas. The Federal Aviation Administration (FAA), as the Aeronautical Advisory Group (AAG) chair, is responsible for engineering and coordination within the 5091-5150 MHz band. In 2012, aeronautical mobile telemetry (AMT) transmissions were permitted in accordance with World Radiocommunication Conference (WRC-15) Resolution 418.

#### **3. Coordination.**

a. All proposed frequency assignment actions shall be coordinated by the applicant with the appropriate AFC listed in Annex D, Table 3 and Figure 3. The procedures for coordination will be those mutually agreeable to the AFC and applicant concerned.

b. AFCs shall coordinate all proposed frequency assignment actions, except those in the Radiolocation Service, with the AFTRCC Coordinator. AFCs shall notify the AFTRCC Coordinator of all proposed frequency assignment actions in the Radiolocation Service in the 2360-2395 MHz band. The procedures for coordination and/or notification will be those mutually agreeable between the AFTRCC Coordinator and AFC concerned.

c. For the 5091-5150 MHz band, all proposed frequency assignments must be coordinated with and approved by the FAA per Annex D, prior to completing the AFTRCC coordination process. As a minimum, AMT operations in the 5091-5150 MHz band must meet the requirements of Resolution 418, including channelization and power flux density (PFD), and will be restricted to flight testing range areas defined in footnote US111. Also, AMT testing will be limited to testing aircraft during non-commercial flights for development, evaluation, and/or certification of aircraft. AMT assignments approved by the FAA must have record note (C090).

d. AFCs will inform applicants of any probability of harmful interference involving proposed frequency assignment actions. If appropriate, the AFC will recommend alternatives and/or restrictions to preclude interference problems. If the applicant wishes, the AFC will recommend a frequency based on the applicant's requirements and the technical particulars furnished by the applicant. The AFC's comments and/or recommendations to the applicant will be based on authorized spectrum usage within the AFC's area of responsibility, coordination with the AFTRCC, and such additional coordination with other entities and activities which the AFC deems appropriate.

4. Applicants shall ensure that the coordination comments of the AFC are included on all frequency assignment actions submitted to the FAS. The FAS shall not recommend approval of assignment actions that do not bear the appropriate Coordination Note indicating completion of the coordination required by these procedures (see Annex A and Annex D, Table 3).

5. To ensure periodic re-evaluation, an expiration date not exceeding 5 years from the date of authorization or revision is required on each frequency assignment in the bands 1435-1525, 2360-2395 and 5091-5150 MHz, except those in the Radiolocation Service in the 2310-2390 MHz band.

6. The NTIA will inform each AFC monthly of all frequency assignment actions affecting the bands 1435-1525, 2360-2395 and 5091-5150 MHz in the areas specified in these procedures.

### **8.3.18 Coordination with or Notification to Non-Federal Advanced Wireless Service Licensees of Changes Involving Federal Satellite Earth Stations Operating in the 1761-1780 MHz Band**

#### **1. General Provisions**

a. In accordance with paragraph (b)(3) of footnote US91 to the National Table of Frequency Allocations, federal earth stations in the space operation service (Earth-to-space) may transmit at 25 specified sites and non-federal base stations must accept harmful interference caused by the operation of these earth stations. In accordance with the Note to paragraph (b)(3), if required, successfully coordinated with all affected AWS licensees, and authorized by NTIA, reasonable modifications of these grandfathered federal systems beyond their current authorizations or the addition of new earth station locations may be permitted. This section sets forth coordination and notification requirements, unless otherwise specified in a coordination agreement with an affected licensee. Modification of a grandfathered federal earth station in the space operation service (Earth-to-space) in the 1761-1780 MHz band beyond its current authorization, or the addition of a new earth station in this band, will not be authorized by NTIA until compliance with the following procedures has been accomplished.

b. For purposes of this section and the following procedures,

(1) a "current authorization" includes any existing and effective (i) certification of spectrum support for a system that includes a grandfathered federal earth station or (ii) frequency assignment for one of the 25 grandfathered federal earth station sites;

(2) an "affected licensee" includes any Advanced Wireless Service (AWS) licensee in the 1761-1780 MHz band (or the FCC for any license not held by a licensee) whose license area is fully or partially within:

(a) the applicable US91-site coordination polygon set forth in Appendix C-2 of the 2014 FCC-NTIA *Joint Public Notice*<sup>13</sup>; or

(b) a new -101.5 dBm received-signal-level contour generated under paragraph 3.a.(2)(i) below.

(3) a "US91-site area" is the applicable geographic area represented by the boundaries surrounding the 25 locations specified in footnote US91(b)(3) to the National Table of Frequency Allocations and as depicted in the shape files available at <https://www.ntia.doc.gov/other-publication/2015/aws-3-coordination-procedures>.

(4) "Commerce Spectrum Management Advisory Committee (CSMAC) WG-3 analysis" refers to Section 4.2.3.2 – Baseline scenario, 3 dB desensitization contour (-101.5 dBm) of the CSMAC Working Group 3 (WG-3)

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<sup>13</sup> See "FCC and NTIA: Coordination Procedures in the 1695-1710 MHz and 1755-1780 MHz Bands," GN Docket No. 13-185, *Joint Public Notice*, 79 FR 54710, 54717-18 (Sept. 12, 2014), 29 FCC Rcd 8527, 8554 (2014) available at [https://apps.fcc.gov/edocs\\_public/attachmatch/DA-14-1023A1\\_Rcd.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DA-14-1023A1_Rcd.pdf).

report dated July 19, 2013.<sup>14</sup>

c. Each applicable agency operating satellite earth stations in the 1761-1780 MHz band is strongly encouraged to establish an ongoing relationship and enter into an operator-to-operator coordination agreement, through the process established in the 2014 FCC-NTIA *Joint Public Notice*<sup>15</sup> or through other means, with each affected licensee to facilitate ongoing exchanges of information and cooperation in matters subject to subsection (b) of footnote US91 to the National Table of Frequency Allocations and Section 27.1134(f) of the FCC rules.

## **2. Specific Coordination Provisions**

a. Before an agency seeks NTIA authorization to (i) add an earth station location outside a US91-site area, or (ii) increase the EIRP of a current authorization within a US91-site area higher than the EIRP level set forth in Table 1 below, or (iii) add a new site within a US91-site area with a higher EIRP level than set forth in Table 1 below, the agency shall successfully coordinate with each affected licensee.

b. To document the requirements of paragraph (a) above, concurrent with any request for frequency assignment action or certification of spectrum support, the agency shall provide NTIA written evidence of the successful coordination with each affected licensee at [US91@ntia.doc.gov](mailto:US91@ntia.doc.gov).

## **3. Additional Notification Provisions**

a. Before an agency seeks NTIA authorization for a request not covered by paragraph 2 above that involves a proposed change to a current authorization or certification for an earth station location or antenna feed elevation within a US91-site area, or a new earth station location within a US91-site area, the agency shall:

(1) notify each affected licensee at least 30 days prior to submitting the request to NTIA; and

(2) provide each affected licensee a -101.5 dBm received-signal-level contour plot in the form of a GIS object (e.g., shapefile or kml format) generated using the CSMAC WG-3 analysis methodology for both (i) the proposed operation and (ii) the original configuration modeled in the CSMAC analysis for that site.

(3) Work with the affected AWS-3 licensees in good faith to mitigate increases in potential interference (as defined by the CSMAC WG-3 analyses), to include possibly modifying the earth stations.

b. For all other new requests, or changes to frequency authorization or certification of spectrum support for earth stations operating in US91-site areas, an agency will notify each affected licensee of the details of the new request or change as it relates to the CSMAC WG-3 assumptions 30 days prior to submitting a request to NTIA.

c. Concurrent with any request for NTIA authorization under paragraph (3)(a), the agency shall provide NTIA documentation of:

(1) the initial notification(s) required under paragraph (3)(a) and any subsequent notifications; and

(2) the affected licensee's acknowledgement of receipt of the initial or subsequent notification; or

(3) any correspondence necessary to establish that the notification was transmitted in good faith and that the receiving party did not acknowledge receipt.

(4) a copy of the -101.5 dBm received-signal-level contour plot in the form of a GIS object (e.g., shapefile or kml format) generated using the CSMAC WG-3 analysis methodology for both (i) the proposed operation and (ii) the original configuration modeled in the CSMAC analysis for that site as required under (3)(a).

**Table: Grandfathered US91-Site Area Earth Station Parameters**

US91 Sites	Latitude	Longitude	Elevation above MSL (m)	Max Transmit Power (dBW)	Max Antenna Gain (dB)	EIRP (dBw)
Annapolis	38-59-26.93N	76-29-24.74W	24	14.8	36	50.8
Buckley	39-42-55N	104-46-29W	1726	32	43	75
Blossom Point	38-25-53.5N	77-05-06.4W	19	25	46	71
Cape GA, CCAFB	28-29-03N	80-34-21W	6	24	40	64
Camp Parks	37-43-51N	121-52-50W	300	30	42	72
Schriever AFB	38-48-21.6N	104-31-40.8W	1910	31.2	45	76.2
Cape Canaveral AFS	28-29-09N	080-34-33W	2	23	28	51

<sup>14</sup> See CSMAC, "1755-1850 MHz Satellite Control and Electronic Warfare," Final Report of Working Group 3 (July 19, 2013), available at [http://www.ntia.doc.gov/files/ntia/Working\\_Group\\_3\\_Final.pdf](http://www.ntia.doc.gov/files/ntia/Working_Group_3_Final.pdf).

<sup>15</sup> See *Joint Public Notice*, 79 FR 54710, 54717-18 (Sept. 12, 2014); 29 FCC Rcd at 8541-42, 8567-69.



Fairbanks	64-58-26N	212-29-39E	385	25	43	68
Ft Bragg	35-09-04N	78-59-13W	89	24	26.8	50.8
Ft. Belvoir	38-44-04N	077-09-12.5W	61	25	40	65
Ft. Hood	31-08-57N	97-46-12W	300	24	26.8	50.8
NAVSOC Det. Charlie	13-34-57.6	144-50-31.6E	208	15	40	55
Andersen AFB	13-36-54N	144-51-21.6E	218	37.1	45.1	82.2
Huntington Beach	33-44-49.89N	118-2-3.84W	11	24	26.8	50.8
Kaena Point, Oahu	21-33-43.2N	158-14-31.2W	430	32.1	45.4	77.5
Joint Base Lewis-McChord	47-06-11N	122-33-11W	86	24	26.8	50.8
Kirtland AFB	34-59-46N*	106-30-28W	1600	28	38.4	66.4
JIATF-S Key West	24-32-36N	81-48-17W	2	24	26.8	50.8
Laguna Peak	34-06-31N	119-03-53W	439	31	43	74
Monterey	36-35-42N	121-52-28W	102	14.8	36	50.8
New Boston AFS	42-56-45.6N	71-37-44.4W	200	38.6	45	83.6
Prospect Harbor	44-24-16N	068-00-46W	6	31	38	69
Patuxent River NAS	38-16-28N	76-24-45W	6	24	26.8	50.8
Sacramento	38-39-59N	121-23-33W	23	24	26.8	50.8
Vandenberg AFB	34-49-22.8N	120-30-7.2W	269	37.1	45	82.1
* Corrected Kirtland AFB coordinates.						

### 8.3.19 Coordination of Assignments in the Band 406.1-410 MHz to Stations (Other Than Mobile) in the Vicinity of Certain Radio Astronomy Observatories

In order to minimize possible harmful interference to radio astronomy observations, all proposed frequency assignments in the band 406.1-410 MHz to stations (including stations to be established under group authority), other than mobile stations, within the following areas, shall be coordinated by the applicant through the National Science Foundation, 4201 Wilson Boulevard, Room 1030, Arlington, VA 22230, Telephone: 703-292-4896.

*a. Arecibo Observatory*

Rectangle between latitudes 17°30'N and 19°00'N and between longitudes 65°10'W and 68°00'W.

*b. Owens Valley Radio Observatory*

Two contiguous rectangles, one between latitudes 36°N and 37°N and longitudes 117°40'W and 118°30'W, and the second between latitudes 37°N and 38°N and longitudes 118°W and 118°50'W.

*c. Sagamore Hill Radio Observatory*

Rectangle between latitudes 42°10'N and 43°00'N and longitudes 70°31'W and 71°31'W.

*d. Table Mountain Solar Observatory*

(NOAA) Boulder, Colorado (407-409 MHz only) rectangle between latitudes 39°30'N and 40°30'N and longitudes 104°30'W and 106°00'W or the Continental Divide, whichever is farther east.

### 8.3.20 Coordination of Assignments to Stations (other than Mobile) to be located in the Vicinity of the Table Mountain Radio Receiving Site, Boulder, Colorado

1. In order to minimize possible harmful interference at the Table Mountain Receiving Site of the Department of Commerce Boulder Research Laboratories, Boulder County, Colorado, all proposed frequency assignments to stations (including assignments to stations to be established under group authority), other than mobile stations, within specified conditions of power and radial distances from a central point on the Table Mountain Receiving Site (coordinates, 40°07'50"N latitude, 105°14'40"W longitude) as given below, shall be coordinated prior to authorization with the Radio Frequency Manager, Department of Commerce, 325 Broadway, Boulder, CO 80305. The contact information is phone: 720-626-0499, and E-mail: [frequencymanager@ntia.gov](mailto:frequencymanager@ntia.gov).

2. The conditions of power and radial distances are:

- All stations within 2.4 kilometers.
- Stations with 50 W or more ERP within 4.8 kilometers.
- Stations with 1 kW or more ERP within 16 kilometers.
- Stations with 25 kW or more ERP within 80 kilometers.

3. Field strengths of any radiated signals (excluding reflected signals) received on this 1800 acre site resulting from the operation of radio stations authorized after January 1, 1973, or from the modification or relocation of



stations authorized after that date, should not exceed the following instantaneous values:

Frequency Range	Field Strength (mV/m) in Authorized Bandwidth of Service	Power Flux Density* (dBWm5) in Authorized Band width of Service
Below 540 kHz	10	- 65.8
540-1600 kHz	20	- 59.8
1.6-470 MHz	10	- 65.8 **
470-890 MHz	30	- 56.2 **
Above 890 MHz	1	- 85.8 **

\* Equivalent values of power flux-density are calculated assuming a free-space characteristic impedance of 20 (approximately 376.7) ohms.

\*\* Space stations shall conform to the power flux-density limits at the Earth's surface specified in Section 8.2.36, but in no case should exceed the above levels in any 4 kHz band for all angles of arrival.

4. The field strengths as given above should be determined in accordance with current engineering standards and practices.

5. The foregoing is not intended to establish a policy of exclusion but each proposal will be considered on its merits, on a case-by-case basis.

### 8.3.21 Coordination of High Frequencies for Projects and Systems Involving Oceanographic Data Transmissions

1. Radio frequencies in the bands 4063.3-4064.8, 6261.3-6262.5, 8340.3-8341.5, 12420.3-12421.5, 16617.3-16618.5, and 22240.3-22241.5 kHz used for transmission and reception of oceanographic data require specialized coordination procedures.

2. Accordingly, any operational use of the Appendix 17 oceanographic data transmission frequencies should be in accord and/or compatible with the Plan(s) developed by the IOC/WMO, if international protection and BR registration are desired.

### 8.3.22 Use of Aeronautical Mobile (R) Service Channels in the 5000-5010 MHz Band

1. The band 5000-5010 MHz is allocated on a primary basis to the aeronautical radionavigation service, the aeronautical mobile satellite (R) service, the radionavigation satellite service (RNSS) (Earth-space) and the aeronautical mobile (R) service (AM(R)S). The allocation to the AM(R)S includes provisions to ensure that stations in the AM(R)S do not cause harmful interference to RNSS space station receivers.

2. The U.S. has approved plans for the next-generation Global Positioning System (GPS) use of the 5000-5010 MHz band for tracking, telemetry, and command (TT&C) functions. Per the allocation, AM(R)S stations in the 5000-5010 MHz band, limited to surface applications at airports, shall be restricted as necessary, including reducing throughput and/or precluding use of certain AM(R)S channels in certain geographic locations as necessary to ensure protection from harmful interference of the AM(R)S and the safe operation and development of RNSS stations operating in this band. Though all current GPS TT&C stations are fixed, it is possible that in the future: 1) GPS TT&C stations may be transportable and 2) TT&C stations may need to be located near an airport. If the required separation distances cannot be maintained, certain AM(R)S channels may not be useable at those geographic locations.

a. Since the AM(R)S shall meet SARPs requirements published in Annex 10 of the ICAO Convention on International Civil Aviation and shall operate according to those characteristics and requirements, where SARPS are not in agreement with U.S. national regulations, U.S. national regulations will take precedence.

b. When RNSS TT&C frequency assignments are proposed for the 5000-5010 MHz band, the FAA and DOD will work cooperatively to, for that specific geographic location, determine necessary separation distances to ensure safe operation of the AM(R)S. Any AM(R)S operations in the band 5000-5010 MHz occurring within that separation distance will be precluded as necessary to ensure protection of the AM(R)S. Upon receipt of a complaint of harmful interference to the RNSS operating in that band, the AM(R)S shall take all necessary steps to immediately eliminate the interference, to include cease of operations in that band, and thereafter enter into discussions with NTIA and DOD, concerning permanent means to prevent any recurrence.

c. The FAA shall not use the requirement to vacate AM(R)S channels in the 5000-5010 MHz band as rationale

for opposing RNSS TT&C frequency assignments in that band.

d. All AM(R)S stations proposed for operation in the 5000-5010 MHz band will be submitted to the SPS for systems review under the provisions of Chapter 10 prior to submission of requests for frequency assignment.

e. In requesting frequency assignments, the FAA shall attempt to first satisfy the spectrum requirements for the AM(R)S surface application systems in the band 5091-5150 MHz.

f. The maximum possible instantaneous effective isotropically radiated power from any single AM(R)S shall not exceed 40.6 dBm/10 MHz below 5 degrees elevation, or 37.1 dBm/10 MHz at or above 5 degrees elevation, which will ensure protection of RNSS systems operating in this band.

g. The coordination distance for AM(R)S stations operating in the band 5000-5010 MHz with respect to stations in the radio astronomy service operating in the band 4990-5000 MHz shall be 150 km.

### **8.3.23 Coordination of Assignments to Federal Broadcasting Stations (Other Than International Broadcasting)**

1. Proposed assignments to federal broadcasting stations (AM, FM, and TV) within areas where the FCC exercises jurisdiction over non-federal radio services in the bands 535-1605 kHz (AM), 54-72 MHz (TV), 76-88 MHz (TV), 88-108 MHz (FM), 174-216 MHz (TV), and 470-806 MHz (TV), shall be coordinated with the FCC Liaison Representative, IRAC. General criteria applicable to such federal broadcasting are:

a. The use of a broadcasting frequency by a station licensed by the FCC, as prescribed in its rules and standards, shall not be restricted or precluded.

b. The station shall not provide service to civilian populations being served by non-federal broadcasting stations, except in emergencies.

c. The station shall not cause harmful interference, as determined under FCC rules, to FCC-licensed broadcasting stations or to stations in other countries in contravention of existing treaties or agreements.

d. Operation of the station shall be discontinued upon notification by the FCC that harmful interference is being caused to any authorized non-federal broadcasting station.

e. Concurrence by the FCC may be reconsidered if continued operation is judged to impede the orderly development of private broadcasting or otherwise contravene the public interest.

f. Proposals shall be coordinated with the FCC at least 80 days before the operation is expected to commence.

g. The following general limitations shall apply to federal broadcasting stations:

(1) Medium wave AM, TV, and FM stations (except for G2 below) will not be authorized within the conterminous U.S. This restriction does not apply to translators. (See II B below.)

(2) Federal low power educational FM stations in the conterminous U.S. will be limited to federal educational institutions offering curriculums similar to those of private or state supported colleges and universities.

2. Such request for coordination with the FCC shall contain the following information:

a. For all proposals:

(1) Frequency

(2) Transmitter power (rated)

(3) Name of transmitter location

(4) Antenna location (latitude/longitude)

(5) Bandwidth/emission

(6) Definition of the area to be served (preferably on a local map)

(7) Applicable IRAC record notes

(8) Letter of consent from the owner of commercial and educational stations if their programming is to be rebroadcast or retransmitted.

(9) Statement indicating why the service desired is not available from commercial or educational stations.

(10) Identity of broadcasting stations presently providing service to the area (AM, FM, and TV stations, including translators).

(11) Identity of broadcasting stations considered in electromagnetic interference or feasibility studies and the potential interference impact upon them from the proposed operation.

b. For FM and TV proposals, the following is also required:

(1) Effective radiated power

(2) Antenna type and gain

(3) Antenna height above mean sea level

(4) For translators furnish height above ground. For other operations provide antenna height above average

terrain:

(a) Average elevation of terrain along each of 8 radials from 3.2 to 16 kilometers from antenna at 45 degree azimuth intervals starting at 0 degrees azimuth.

(b) Average elevation of all 8 radials.

(5) Plot of the horizontal and vertical field intensity radiation patterns if a directional antenna is used (including beam tilt).

c. For AM broadcast proposals for transmitters of 100 watts output power or more, the following additional information shall be supplied in order for the FCC to make its studies and to provide the required international notifications pursuant to applicable international broadcasting agreements (not related to ITU notifications):

(1) The power into the antenna feed point, if significantly different from the transmitter output power.

(2) Description of antenna system to include, but not limited to the following:

(a) Effective radiating height

(b) Diagram of top-loading or sectionalizing, if used

(c) Number of ground systems radials and radial length

(d) For omni-directional antennas--Predicted unattenuated radiated field (mV/m/kW)

(e) For directional antennas--The directional antenna radiation patterns; horizontal only for daytime and horizontal and vertical angles for nighttime operations at increments of 10° through and including 60° in the vertical. Also, the theoretical values for each tower of field ratio and current phase angle, and tower placement sketch showing spacing and orientation of towers.

### 8.3.24 Coordination of Frequencies Used for Communications with Non-Federal Citizens Band Stations

1. A federal radio station may utilize frequencies in the range 26960-27410 kHz which are allocated to the Citizens Band (CB) Radio Service under Part 95, Subpart D of the FCC Rules provided:

a. an appropriate showing can be made by the applicant that such an assignment is necessary for intercommunications with non-federal stations, and

b. the requirement is coordinated with and concurred in by the FCC.

2. All operations by federal stations under this provision shall be in accordance with FCC Rules and Regulations Part 95, Subpart D. Transmitters shall be operated only by employees of the Federal Government and only for the purpose of interfacing with non-federal licensees to coordinate essential and mutual activities. The authority shall be subject to being revoked by the FCC at its discretion at any time. These assignments shall include record note S348.

3. The specific channels are:

Channel	Frequency (kHz)	Channel	Frequency (kHz)
1	26965	21	27215
2	26975	22	27225
3	26985	23	27255
4	27005	24	27235
5	27015	25	27245
6	27025	26	27265
7	27035	27	27275
8	27055	28	27285
9	27065	29	27295
10	27075	30	27305
11	27085	31	27315
12	27105	32	27325
13	27115	33	27335
14	27125	34	27345
15	27135	35	27355
16	27155	36	27365
17	27165	37	27375
18	27175	38	27385
19	27185	39	27395
20	27205	40	27405

### 8.3.25 Coordination Procedures for the 932-935 MHz and 941-944 MHz Bands

1. The frequencies shown in Section 4.3.14 are shared by the federal and non-federal on a co-equal basis for the fixed service. Although coordination and frequency assignment procedures are unique to federal and non-federal users, these procedures are similar enough to allow for concurrent processing of applications.

a. For filing applications, federal and non-federal applicants will continue to use the existing procedures; i.e., federal applications will be submitted to the NTIA and non-federal applications will be submitted to the FCC.

b. Non-federal applications will be provided to the NTIA by the FCC through their FAS representative, and federal applications will be provided to the FCC's FAS representative by NTIA. To affect federal/non-federal coordination, both federal and non-federal applications will be placed on the FAS agenda and will be listed in a public notice to be released by the FCC.

c. The following data fields are identified as the minimum necessary for federal/non-federal coordination:

FAS docket number (DKT), frequency (FRQ), emission characteristics including bandwidth (EMS), output power (PWR), station class (STC), transmitter state/country (XSC), transmitter antenna latitude and longitude (XLA, XLG)<sup>16,17</sup>, transmitter antenna dimensions (XAD)<sup>17</sup>, transmitter antenna polarization (XAP)<sup>17</sup>, transmitter antenna azimuth (XAZ)<sup>17</sup>, receiver state/country (RSC), receiver antenna latitude and longitude (RLA, RLG)<sup>16,17</sup>, antenna dimensions (RAD)<sup>17</sup>, receiver antenna polarization (RAP)<sup>17</sup> and receiver antenna azimuth (RAZ)<sup>17</sup>.

### 8.3.26 Coordination of Federal Radio Operations with DOD Area Frequency Coordinators in Frequency Bands Above 420 MHz

1. The following policy applies to federal ground or airborne transmitters in the subject frequency range planned to operate within radio line-of-sight of, or close enough to cause interference to, the areas listed in Table 8.3.26. For the purpose of this procedure line-of-sight is defined by the formula  $D = \sqrt{2h_r} + \sqrt{2h_t}$ , where D is the radio line-of-sight distance in miles and ht is the height of the transmitter antenna in feet, and hr is the height of the receiver antenna in feet.

2. In order to minimize potential mutual electro-magnetic interactions in, near and within line-of-sight of, DoD test ranges, DoD Area Frequency Coordinator(s) (AFC) shall be notified of:

a. Pending actions (e.g., new, modifications, etc.) directly from the NTIA. AFCs must forward any comments to the appropriate MILDEP FAS representative within 10 working days of the initial processing date (IPD) indicated on each action.

b. Activation of approved USA/USP, wide area, band, and transportable assignments by representatives of federal government agencies, including DOD, prior to transmitting.

3. Notification for ground-based systems must include agency point-of-contact (POC), frequency, power, location, type emission including bandwidth, antenna gain, antenna information (height, elevation, azimuth) and any other information that will help to define, eliminate or manage any potential operational conflicts. In addition, airborne operations (other than for standard aircraft flight navigation and communication systems) require data such as flight profile, duration of mission, elevation, etc.

**Table: 8.3.26 - DoD Test Ranges, Areas of Concern, and Applicable Coordination Note**

Activity	Area of Concern	Coordination Note
U.S. Air Force Weapons and Tactics Center Nellis AFB, NV DSN: 683-3417 (702) 652-3417	Entire State of Nevada plus Utah West of 111°W and Idaho South of 44°N.	C067
U.S. Air Force Eastern Test Range Patrick AFB, FL DSN: 854-5837 (407) 494-5837/5838	Area bounded by 24°N, 31°30'N, 77°W, and 83°W.	C004
U.S. Air Force Air Armament Center Eglin AFB, FL DSN: 875-7535 (850) 850-7535	Area bounded by 24°N, 33°30'N, 83°W and 90°W	C010

<sup>16</sup> The degree of accuracy of all latitudes shall be to the nearest second.

<sup>17</sup> For applications bearing special notes S361 or S362, the rules of Section 9.8.2 apply.

<b>Table: 8.3.26 - DoD Test Ranges, Areas of Concern, and Applicable Coordination Note</b>		
U.S. Naval Air Warfare Center Weapons Division China Lake, CA (NAWCWD) DSN: 437-6948 (760) 939-6948	Area enclosed within a 322 kilometer radius of 340649N1190654W and the area of California that lies south of 37°30'N.	C002
U.S. Army Electronics Proving Ground Ft. Huachuca, AZ DSN: 879-6423 (602) 538-6423	Entire State of Arizona	C008
CINCPAC (JFMOPAC) Military Ranges within the State of Hawaii (U.S. Air Force) DSN: 315-477-1054 (808) 477-1054	Area enclosed by a 322 kilometer radius of 211900N1575200W	C012
U.S. Navy Atlantic Fleet Weapons Training Facility, Roosevelt Roads, Puerto Rico (AFWTF) DSN: 831-5227/3270, (809) 865-5227/3270	Area within a 370 kilometer radius of 181500N0653800W	C093
U.S. Army White Sands Missile Range Las Cruces, NM (WSMR) DSN: 258-5417 (505) 678-5417	Entire State of New Mexico, Texas west of 104°W and the areas of Utah and Colorado between 108°W and 111°W.	C006
U.S. Navy, Naval Air Warfare Center Aircraft Division, Patuxent River, MD (NAWCAD) DSN: 342-1532/1194, (301) 342-1532/1194	Area enclosed by a 320 kilometer radius of 381718N0762500W	C094

### 8.3.27 Notification in the Bands 10-490 kHz

1. The frequencies 10-490 kHz are used to operate electric utility Power Line Carrier (PLC) systems on power transmissions lines for communications essential to the reliability and security of electric services to the public, in accordance with footnote US2 of the Table of Frequency Allocations and Part 15 of the FCC Rules. PLC systems in this band operate on a noninterference basis to radio systems assigned frequencies by NTIA or licensed by the FCC and are not protected from interference caused by these radio operations.

2. Any electric utility that generates, transmits, or distributes electrical energy for use by the general public by the member of a cooperative organization may operate PLC systems and shall supply, to the FCC/NTIA recognized industry-operated entity, information on all existing, changes to existing, and proposed systems for inclusion in a data base.

a. Such information shall include the frequency, power, location of transmitter(s), location of receivers and other technical and operational parameters, which would characterize the system's potential both to interfere with authorized radio users, and to receive harmful interference from these users.

b. In an agreed format, the industry-operated entity shall inform the NTIA and the FCC of these systems' characteristics prior to implementation of any proposed PLC system and shall provide monthly or periodic lists with supplements of PLC systems.

3. The FCC and NTIA will supply appropriate application and licensing information to the notification activity regarding authorized radio stations operating in the band.

### 8.3.28 Use of Fixed Devices That Re-Radiate Signals Received From the GPS

Except as otherwise authorized under Section 7.14, federal agencies and departments may, under the following conditions, operate fixed devices that re-radiate signals received from the GPS or other Radionavigation Satellite Service (RNSS).

a. Individual authorization is for indoor use only, and is required for each device at a specific site. If more than ten devices may operate in a single site/building - whether continuously or intermittently - the frequency assignment must note the total number of reradiators and maximum EIRP of the most powerful re-radiator device.

b. Applications for frequency assignment should be applied for as an XT station class with a note indicating the device is to be used as an "Experimental RNSS Test Equipment for the purpose of testing RNSS receivers" and describing how the device will be used.

c. Approved applications for frequency assignment will be entered in the GMF.

- d. The maximum length of the assignment will be two years, with possible renewal.
- e. The area of potential interference to GPS reception (e.g., military or contractor facility) has to be under the control of the user. Areas beyond the range for potential interference are protected by the maximum power calculation described in f. below, and thus no further record notes are required for frequency assignments.
- f. The EIRP must be such that the emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from the building where the test is being conducted. The calculation for maximum EIRP shall be based on free space propagation with no allowance for additional attenuation (e.g., building attenuation) as shown below.

$$P_{Tmax} = P_R + 20 \log_{10} f + 20 \log_{10} (30 + d) - 27.55$$

Where:  $P_{Tmax}$  is the maximum permissible EIRP in dBm  
 $P_R$  is the power received at 30 meters from the building (i.e. -140 dBm/24 MHz)  
 $f$  is frequency in MHz (i.e. 1575.42 for L1, 1227.60 for L2, 1176.45 for L5)  
 $d$  is the distance between the radiator and the closest exterior wall of the building in meters.

$P_{Tmax}$  can then be converted to picowatts by using the formula:  $P_{Tmax(pW)} = 10^{\left(\frac{P_{Tmax}}{10} + 9\right)}$

Applications requesting power greater than the  $P_{Tmax}$  calculated at  $d = 0$  meters (i.e. 39.3 pW for L1, 23.8 pW for L2, and 21.9 pW for L5) must provide the distance from the transmit antenna to the nearest exterior wall so that reviewing agencies can determine if the requested power meets the maximum EIRP described above.

- g. Applications requesting consideration of non-zero building attenuation in order to meet the -140 dBm/24 MHz limit at 30 meters from the building must provide detailed justification and measured values for the building attenuation for agency review.
- h. GPS users in the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.
- i. The use is limited to activity for the purpose of testing RNSS equipment/systems.
- j. A "Stop Buzzer" point of contact for the authorized device must be identified and available at all times during these re-radiator operations..

### 8.3.29 Use of Land-Based Mobile Devices That Re-Radiate Signals Received From the GPS

Except as otherwise authorized under Section 7.14, federal agencies and departments may, under the following conditions, operate land-based mobile devices that re-radiate signals received from the GPS at 1575.42 ±12 MHz (L1).

- a. Use is restricted to inside armored ground vehicles operating within a federal controlled range/facility/installation or cordoned zone.
- b. Applications for frequency assignment shall be applied for as an "NR" station class with a note describing how the device will be used.
- c. Approved applications for frequency assignment will be entered in the GMF.
- d. The maximum length of assignment will be two years, with possible renewal.
- e. The application for frequency assignment shall indicate the agency or department controlled range/facility/installation or cordoned zone of operation and the number of vehicles equipped with these devices.
- f. The entire area of potential interference to GPS reception (e.g., military/federal range/facility/installation or cordoned area) must be under the control of the federal user.
- g. The maximum EIRP must be such that the calculated emissions are no greater than -88 dBm/24 MHz at the output of GPS reradiator antenna (-144 dBm/24 MHz at 10 meters as received by an isotropic antenna) from an armored ground vehicle.
- h. GPS users within the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.
- i. A "Stop Buzzer" point of contact for the authorized device must be identified and available at all times during GPS reradiator operations.
- j. These devices operate on a non-interference, unprotected basis.

### 8.3.30 Use Inside of Federal Owned Aircraft Devices That Re-Radiate Signals Received From the GPS

1. Except as otherwise authorized under Section 7.14, federal agencies and departments may, under the following conditions, operate inside an agency/department owned aircraft devices that re-radiate signals received from the Global Positioning System (GPS) at  $1575.42 \pm 12$  MHz (L1) and  $1227.6 \pm 12$  MHz (L2).

a. In the design of the re-radiator equipment, all practicable efforts shall be taken to attenuate the emissions outside the bands  $1575.42 \pm 12$  MHz (L1) and  $1227.6 \pm 12$  MHz (L2) as much as possible.

b. Use of the re-radiator is restricted to transmissions inside federal owned aircraft operating within a federal controlled range/facility/installation/cordoned zone. All locations using aircraft re-radiators are required to have a frequency assignment. System checks shall only be performed while the aircraft is on the ground at a federal controlled range/facility/installation/cordoned zone. In addition, operation of the re-radiator while in flight is limited to use during the final 20 minutes before planned deployment of assets.

c. Applications for frequency assignment shall be applied for as an "NR" station class with an explanation describing how the device will be used.

d. Approved applications for frequency assignment shall be entered in the GMF.

e. The maximum length of frequency assignment shall be two years, with possible renewal.

f. The application for frequency assignment shall indicate the agency or department, the federal controlled range/facility/installation/cordoned zone of operation and the number of aircraft equipped with these devices.

g. So as to not interfere with other aircraft, the maximum EIRP must be such that the calculated or measured emissions are no greater than -141 dBm/24 MHz as received by an isotropic antenna at a distance of 20 meters from the aircraft skin with all access doors open. The total GPS re-radiator system group delay shall not exceed 200 nanoseconds.<sup>18</sup>

h. When the re-radiator is being operating on the ground, GPS users within the area of potential interference to GPS reception must be notified that GPS information may be impacted for periods of time.

i. Federal-owned aircraft that use GPS re-radiators shall ensure proper operation of their avionics systems which operate in or near the GPS bands, with the re-radiator active, and should be tested with the aircraft doors open and closed.

j. A "Stop Buzzer" point-of-contact for the authorized device must be identified and available at all times during the GPS re-radiator operations.

k. These devices operate on a non-interference, unprotected basis.

### 8.3.31 Coordinated Use of Federal Fixed Ultrawideband Systems Not Intended for Operation under Parts 7.8 or 7.9

Federal agencies may, on a non-interference basis, operate fixed ultrawideband (UWB) systems that do not conform to Parts 7.8 or 7.9 provided that those systems receive spectrum support in accordance with the provisions of Chapter 10, which with identify the coordination requirements for each operating station, and an approved frequency assignment in accordance with the provisions of Chapter 9. This section is not applicable to mobile systems.

### 8.3.32 Coordination of Special Temporary Authorization Assignments for Federal Agencies

1. The NTIA, in consultation with FAS of the IRAC, may provide short-term temporary authorizations (called

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<sup>18</sup> An example of how to calculate the group delay:

RADAR System Interference Analysis

Component	Time Delay
GAS-1	6.0ns
Cable	24.9ns
Power divider	2.0ns
Amplifier	15.0ns
Total Delay	47.9 nanoseconds

a “Special Temporary Authorization” (STA) to federal users of the electromagnetic spectrum in the US&P. STAs may support requirements including, but not limited to exercises, short-term events, or equipment tests and evaluations of time periods of 30 days or less. Requests for periods slightly longer than 30 days will only be considered on a case-by-case basis by the Frequency Assignment Branch Chief. All other requests need to be submitted as an application for a temporary period (Section 9.6.3) or regular GMF assignment using the operational or experimental station class that is appropriate. The FCC will coordinate their STAs with NTIA in accordance with FCC rules and regulations as required.

2. The approval of an STA does not ensure the FAS will approve the permanent use of the frequency for a GMF assignment. No agency should make long-term decisions based on the short-term use of an STA. Agencies may approve STAs based on limitations of time/use, but require restrictions or object when the same request is for a permanent GMF assignment.

3. NTIA will provide a minimum of 5 business days (excluding holidays and weekends) to circulate non-emergency requests among the impacted users, as it deems appropriate. The submitting agency shall clearly identify STA requests for emergency situations, e.g., disasters, and NTIA will set the comment due date based on the time and dates of the proposed operation.

4. STA data is not entered into the GMF. Twenty-four hour/seven days per week stop buzzer contact information will be provided when requested by other agencies or the FCC when interference is anticipated in order to protect their operations.

5. Prior to requesting an STA, federal agencies need to use assets already registered in the GMF as long as the requirement does not exceed the parameters listed in the permanent authorization.

6. The minimum data required for federal agencies submitting a proposal to the FAS is as follows:

a. CLA (Classification of the request)

b. FOI: (If NTIA receives a Freedom of Information Act (FOIA) request for information concerning a STA, then NTIA will refer any responsive documents and provide a copy of the FOIA request to the FOIA contact of the relevant federal agency so that the agency can respond directly to the FOIA requester).

c. TYP (Type is always “N”)

d. SER (Serial number assigned by the requestor)

e. FRQ (Specific frequency or frequency band)

f. EXD (expiration date of the STA)

g. STC (Station class)

h. EMS (Emission)

i. PWR (Power)

j. XSC (Transmitter state code)

k. XAL (Transmitter antenna location)

l. XLA (Transmitter antenna latitude)

m. XLG (Transmitter antenna longitude)

n. XAD (as applicable)<sup>19</sup> (Transmitter antenna dimensions)

o. XAZ (Antenna azimuth)

p. XAP (as applicable) (Antenna polarization)

q. RSC (Receive State code)

r. RAL (Receive antenna Location)

s. RLA (Receive antenna latitude)

t. RLG (Receive antenna longitude)

u. RAD (as applicable)<sup>15</sup> (receive antenna dimensions)

v. NTS (as applicable) (Record notes; e.g., S, P, M, or L)

w. \*RAD (Radius)

x. EQT (as applicable)<sup>15</sup> (Transmitter equipment)

y. SUP, for explanation of operations to include start date.

z. \*PRD (as applicable) (Paired-with another frequency)

aa. \*FRB (as applicable) (Upper and lower limits of the requested band)

bb. \*FBE (as applicable) (Excluded frequency band data)

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**NOTE 1** - IF XAD and/or RAD are not provided, the proposed height above mean sea level (AMSL) is assumed to be at 6 meters or less.



- cc. \*PRR (as applicable) (Pulse repetition rate, for radar)
  - dd. \*AGN (as applicable) (agency data pertinent to the proposed STA but not intended to be a part of the authority requested)
  - ee. \*NTS (as applicable) (Used for “Minute” notes, only)
7. Processing of a federal STA proposal may be delayed or denied based on, but not limited to, the following criteria:
- a. Harmful interference is anticipated to existing, licensed agency operations. The serial number(s) of the potential victim assignment(s) shall be provided to NTIA by the agency objecting to the proposal.
  - b. If the STA proposal requests access to a specified frequency or band of frequencies without proper pre-coordination, approval may be delayed while coordination is completed.
  - c. If the information provided in the STA proposal is incomplete or inconsistent with the minimum data elements of paragraph 6.
8. The following paragraph will be placed at the bottom of all unclassified Special Temporary Authorization (STA) requests: “I \_\_\_\_\_ have checked the STA and attachments and certify that there is no classified information in this STA request.”

### **8.3.33 Coordination of Frequency Assignments for Unmanned Aircraft Systems**

Federal agencies who have obtained a frequency assignment for Unmanned Aircraft Systems (UAS) operations outside of Restricted or Warning Areas designated for aviation activities must file a FAA Form 7711, Certificate of Waiver or Authorization with the FAA. The form will initiate a comprehensive safety review for the UAS operation and provide airspace coordination with air traffic control facilities. Special note S405 will be entered on all UAS frequency assignments operating outside of Restricted or Warning Areas designated for aviation. For UAS operations within Restricted and Warning Areas designated for aviation activities the specific airspace shall be identified in the frequency assignment and will preclude the submission of FAA Form 7711 and the addition of S405 to the assignment record.

### **8.3.34 Procedures for Coordinating Use of Federal Surface Defect Testing Systems for Low Observable Aircraft**

1. Federal agencies desiring to deploy certified Surface Detection Testing Systems (SDTS) and associated components in a controlled environment to test for surface defects on low-observable (LO) aircraft shall follow the procedures outlined in DSO-CR-13-114, “Assessment of Compatibility between Low Observable (LO) Diagnostic Measurement Systems and Selected Systems” to ensure compatible operations. However, the coordination trigger distance for FAA primary radars that operate above 1 GHz is 25 nautical miles (46 kilometers). Coordination with the FAA will be required when LO systems operate at locations that are in the vicinity of FAA primary radars that operate in the following frequency bands: 1240-1370 MHz, 2700-2900 MHz, 5600-5650 MHz, 9000-9200 MHz, and 15.7-16.2 GHz.

2. LO systems operating at separation distances beyond 25 NM (46 kilometers) of primary radars will not require prior coordination with the FAA for frequency assignment requests with regards to primary radars. Additionally, when LO systems operate at locations in the vicinity of NOAA radars that operate above 1 GHz, 49 nautical miles (90 kilometers) will be used as the trigger distance within which prior coordination with the NTIA Frequency Assignment Subcommittee is required for frequency assignment requests.

3. Rigorous tests, measurements, and analyses in the GPS bands have been accomplished and outlined in reports submitted to the SPS. Users of current and future LO diagnostic radar systems will continue to ensure that GPS operations are protected in line with national policy.

4. Federal agencies desiring to deploy uncertified SDTS and associated components in a controlled environment to test for surface defects on low-observable aircraft shall follow the procedures outlined in Section 7.26 for submitting equipment certification applications to the SPS and frequency assignment requests to the FAS.

## **8.4 COGNITIVE RADIO, DYNAMIC SPECTRUM ACCESS, AND SOFTWARE DEFINED RADIO TECHNIQUES**

Radiocommunication systems using Cognitive Radio, Dynamic Spectrum Access, or Software Defined techniques in any radiocommunications service shall operate in accordance with the provisions of NTIA rules governing those services.

**(Last Page in Chapter 8)**

## Chapter 9

### Preparation of Applications for Frequency Assignment Action

#### 9.1 DETERMINING WHEN THE SUBMISSION OF AN APPLICATION IS REQUIRED

##### 9.1.1 When the Submission of an Application is Required to Obtain Authority to Use a Frequency

1. Except as provided in Section 9.1.2, the submission of an application is required to obtain authority for a federal radio station to use a frequency within the US&P.

2. For satellite systems employing multiple space stations with the same general characteristics, a separate application shall be submitted for each space station on geostationary satellites; for nongeostationary satellites, one application shall be submitted covering all the space stations in the system.

##### 9.1.2 When the Submission of an Application is Not Required to Obtain Authority to Use a Frequency

1. In accordance with the provisions of Section 7.1, the submission of an application is not required to obtain authority to use a frequency above 3000 GHz.

2. Sections 7.3 through 7.17 authorize the use of certain frequencies under specified conditions. The submission of an application is not required to obtain authority for such use, inasmuch as the authority is granted by the Sections cited; however, an application may be submitted, at the option of the applicant, to provide an entry in the GMF.

3. Mobile stations are authorized as a class of station rather than as individual stations, e.g., 25 mobile stations may be authorized by a single application as opposed to 25 applications. The submission of an application is not required to obtain authority for individual mobile stations to use a frequency in those cases in which the frequency is authorized to the agency for use by mobile stations as a class, provided such stations do not exceed the authority granted.

4. Individual user agencies are not required to submit applications to obtain frequency authority for stations operating in a trunked land-mobile radio system. The agency, or designated lead agency managing the system, will obtain authority for all stations that use the system.

5. Transportable operations may be authorized to defined classes of stations, e.g., fixed (FX), by including on the application the record note S362 (Transportable operations). As in the case cited above for mobile stations, transportable operations are authorized to a class of station rather than to individual stations, e.g., 25 fixed stations may be authorized for transportable operations within a specified geographic area by the submission of a single application as opposed to 25 applications. The submission of an application is not required to obtain authority for individual stations to use a frequency for transportable operations, provided the frequency is authorized to the agency for use by such stations as a class, the assignment includes the Record Note S362, and the stations do not exceed the authority of the frequency assignment.

6. A frequency assignment is not required when operation of a radio frequency device is fully contained within an anechoic chamber or a Faraday cage. This use should not cause harmful interference to authorized assignments.

##### 9.1.3 When the Submission of an Application is Required for the Notification of the Use of a Frequency

1. Section 9.1.1 provides for the use of an application to obtain authority for a federal radio station to use a frequency. An application also is used to notify the bringing into use or the intended bringing into use of a frequency under the terms of existing frequency assignment authority or where no frequency assignment authority is required. The cases involving the submission of an application for the notification of the use of a frequency are as follows:

2. The establishment of a station under the authority of a GROUP frequency assignment (see Section 9.6.5) shall be notified prior to the commencement of operations in the following cases:

- a. When coordination with Canada is required (see Section 3.4).
- b. When coordination in respect of the National Radio Quiet Zone is required (see Section 8.3.9).
- c. When coordination in respect of the Table Mountain Radio Receiving Site is required (see Section 8.3.20).

3. The establishment of a station under the authority of a GROUP FREQUENCY ASSIGNMENT shall be

notified prior to or soon after the commencement of operations in the following cases:

a. For the use of a frequency in the bands:

30.00-50.00 MHz	148.00-149.90 MHz	162.00-174.00 MHz
138.00-144.00 MHz	150.05-150.80 MHz	406.10-420.00 MHz

except for periods so limited (on the order of six months or less) that notification would be impracticable, as determined by the applicant, e.g., certain tactical or training operations.

b. For the use of a frequency in the bands:

400.15-406.00 MHz	1660.00-1700.00 MHz
-------------------	---------------------

by meteorological aids at other than transient locations or for periods in excess of 15 days.

c. For the use of any frequency authorized by an assignment bearing Note S322 in the NOTES field, except for periods of use so limited (on the order of six months or less) that notification would be impracticable (see Section 9.6.5).

4. The establishment of a station under the authority of Section 7.5.2 or Section 7.12, may be notified at the option of the agency concerned when it is determined that notification is practicable and desirable.

5. Section 8.3.11 provides that federal agencies shall coordinate with the IRAC certain uses of frequencies by their stations located outside the US&P. For those uses requiring coordination, such coordination may be affected, at the option of the agency concerned, by the submission of an application for the notification of the use of the frequency.

### 9.1.4 Applications Required for Private Contractors

1. If a private contractor requires the use of radio frequencies under the terms of a Federal Government contract, a determination must be made as to whether the federal agency should apply to the IRAC for the frequency authorization or whether the contractor should apply to the FCC. The determination is based upon whether the radio station “belongs to and is operated by” the federal agency or the contractor. Section 305 of the Communications Act of 1934, as amended, provides in part that “Radio stations belonging to and operated by the United States shall not be subject to the provisions of Sections 301 and 303 of this Act. All such federal stations shall use such frequencies as shall be assigned to each or to each class by the President” (see Section 8.2.17).

2. When the FCC coordinates with the FAS of the IRAC a proposed radio frequency authorization to be used directly in support of a Federal Government contract (excluding a grant), the contracting federal agency is responsible for:

a. verifying the validity of the contract, and

b. certifying that the proposed frequency authorization or its equivalent is necessary for the fulfillment of the contract.

## 9.2 SPECIAL INSTRUCTIONS CONCERNING CERTAIN APPLICATIONS

### 9.2.1 Applications Handled by Aeronautical Advisory Group or Military Advisory Group

Application for the use of frequencies in the following bands shall be in accordance with the provisions of Section 9.14 (all ranges are inclusive):

Aeronautical Advisory Group (AAG)		
190-285 kHz	285-435 kHz*	510-535 kHz*
74.800-75.200 MHz	108.000-121.9375 MHz	123.5875-128.8125 MHz
132.0125-137.000 MHz	328.6-335.4 MHz	978-1020 MHz inclusive
1030 MHz	1031-1087 MHz inclusive	1090 MHz
1104-1146 MHz inclusive	1157-1213 MHz inclusive	5000-5250 MHz
* In these bands only applications for stations in the Aeronautical Radionavigation Service (see Table A, Section 6.1.4) shall be sent to the Chairman of the AAG.		

Military Advisory Group (MAG)	
225.0-328.6 MHz	335.4-399.9 MHz

## 9.2.2 Applications for Sounder Network Stations or Sounder Prediction Stations

Applications will be in accordance with Section 8.2.21 and include the following in the SUPPLEMENTARY DETAILS (SUP) field:

a. Channeling plan(s) (required for all sounder network stations and, as applicable, for sounder prediction stations) FOR EXAMPLE:

(1) First octave: 2.075 to 3.975 MHz, 20 channels spaced 100 kHz.

(2) Second octave: 4.150 to 7.950 MHz, 20 channels spaced 200 kHz.

(3) Third octave: 8.300 to 15.900 MHz, 20 channels spaced 400 kHz.

(4) Fourth octave: 16.600 to 31.800 MHz, 20 channels spaced 800 kHz.

(5) For those sounders in which the tuning rate is independent of the pulse rate (e.g., Sounder types C2, C3, and C4), wherein the specific frequencies sounded differ from scan to scan, a channeling plan is not a meaningful item. In application for such sounders, so state.

b. Pulse duration(s)

c. Pulse repetition rate(s)

d. Pulses per channel

e. Scan rate(s)

f. Scan interval(s) (time between scans)

g. Antenna type

h. Antenna azimuth (if directional, indicate azimuth of major lobe).

## 9.2.3 Reserved

## 9.2.4 Use of Data Plots and Coordination Contour Maps

1. When requesting assignments, it may be necessary to review a data plot and/or coordination contour map prior to receiving authority to operate:

a. in the bands:

1710-1850 MHz

2200-2290 MHz

4400-4990 MHz

7125-7250 MHz

7300-7975 MHz

8025-8500 MHz

for fixed stations involving a communications system which consists of more than two stations that are interconnected (transportable stations and those located outside of the western hemisphere and south of the equator are exempt); or

b. in the band 7900-8400 MHz for transportable earth stations.

2. Before requesting data plots or coordination contour maps, and prior to submitting the frequency assignment proposal to NTIA, the proposing agency shall coordinate with other agencies having existing assignments in the frequency band(s) and geographic area(s) in which the proposed assignment is being requested.

a. If coordination is successful between concerned agencies without the need for data plots or coordination contour maps, the frequency assignment proposal shall include a statement in the FAS field that coordination between concerned agencies determined that data plots and/or coordination contour maps were not required.

b. If any concerned agency desires to review a data plot prior to coordinating on the proposed assignment, the applicant shall submit a copy of the application to the FAS Secretary covered by a memorandum indicating data plots are being requested. The applicant shall include a statement in the FAS field that data plots have been requested.

3. For transportable earth station proposals in the band 7900-8400 MHz, successful coordination may not be accomplished even after data plots have been prepared and reviewed. In these cases, the applicant shall provide coordination contour maps to the FAS Secretary. The proposing agency shall include a statement in the FAS field that coordination contour maps have been provided. The methods described in OTP Report 76-99 "Electromagnetic Compatibility of the Department of Defense Ground Mobile Forces Transportable Earth Terminals with Terrestrial Systems within the 7.2-8.4 GHz Spectrum" shall be used to produce the coordination contour maps.

4. The procedures of Section 9.2.4 paragraphs 1 through 3 shall be used in the processing of applications for NEW actions and for MODIFICATION actions which would increase the probability of harmful interference. In the

latter case, the record replacement procedure shall be used in lieu of submitting an assignment modification action.

5. Data plots and coordination contour maps will be distributed by the FAS Secretary to agencies having a direct interest in the proposal.

## **9.2.5 Frequency Assignments for Use of Federal Fixed Ultrawideband Systems Not Intended for Operation under Sections 7.8 or 7.9**

1. Agencies desiring to deploy fixed UWB systems that do not conform to Sections 7.8 or 7.9 and having received spectrum support in accordance with Chapter 10, Section 10.3.8 shall request a frequency assignment prior to operation. Considering the analyses that resulted in spectrum support, no further analysis regarding protection of federal operations should be required to approve these assignments. The FCC will have the opportunity to review the request with respect to protection of non-federal users. Each successfully coordinated operation will be approved to operate on a non-interference basis. Therefore, if in the future any federal agency or non-federal entity implements or expands an authorized system at distances from the UWB devices that are closer than has been demonstrated to be compatible, the UWB system will have to cease operation unless its compatibility can be reestablished prior to operation of the authorized system. Furthermore, in the future, federal agencies or non-federal users may develop new authorized radiocommunication systems that will have to be evaluated. Calculation of associated distances may indicate that the deployment of these new authorized systems will be at distances from the UWB devices that are closer than has been demonstrated to be compatible. Similar to the previously noted situation, the UWB device will need to cease operations unless its compatibility can be reestablished prior to the operation of the authorized system.

2. In this context, NTIA will consider any such requests received from the FCC through the FAS for non-federal UWB operations that do not conform to the FCC Rules Part 15. In each case, the requested location will be evaluated in terms of its separation distance from federal systems on the List. Operations proposed for locations at closer distances will require further evaluation through measurements or analyses. NTIA will support such non-federal use if it falls outside the distances that NTIA has determined as necessary for compatibility with federal systems on the List. This support will only be given with the understanding that such non federal operations will be required to meet the same non-interference requirement with respect to existing and future authorized operations, including ceasing operations unless, prior to the operation of new federal authorized systems, compatibility has been established at distances closer than has been previously demonstrated to be compatible.

## **9.3 SUBMISSION OF FAS AGENDA MATERIAL**

### **9.3.1 Frequency Assignment Applications**

1. Applications from FAS Member Agencies shall be submitted as indicated below. See also Part 14 for frequency applications which will be considered by the AAG or the MAG. Applications classified CONFIDENTIAL may be transmitted employing Spectrum XXI for Department of Defense users or compact discs for other federal agency users.

a. Electronic Transmission. Applications may be transmitted electronically to NTIA, Spectrum Services Division (SSD) via Spectrum XXI for authorized users or the Data Capture and Forwarding System (DCFS) [dcfs.ntia.doc.gov](http://dcfs.ntia.doc.gov).

b. Magnetic Disc. Under special circumstances and by prior arrangement with the FAS Chairman, agencies may physically deliver a magnetic disc to the NTIA/OSM/SSD at:

U.S. Department of Commerce  
NTIA/OSM/SSD  
Room 1982, Herbert C. Hoover Building  
1401 Constitution Avenue, N.W.  
Washington, DC 20230

2. U.S. Government agencies that are not members of the FAS and are not represented on the FAS by an FAS Member Agency are represented by the NTIA/OSM/SSD. Those agencies shall send their frequency assignment requests to:

U.S. Department of Commerce

NTIA/OSM/SSD  
Room 1982, Herbert C. Hoover Bldg.  
1401 Constitution Avenue, N.W.  
Washington, DC 20230

### 9.3.2 SECRET Documents, Supplemental Material and Administrative Agenda Items

Documents containing SECRET data, supplemental materials supporting frequency assignment applications (such as charts, maps, etc.), and items for the FAS Administrative Agenda shall be forwarded to the FAS Secretary. Items for the administrative agenda must reach the FAS Secretary no later than the close of business four working days prior to the FAS meeting.

U.S. Department of Commerce  
NTIA/OSM/SSD  
ATTN: FAS Secretary  
Room 1982, Herbert C. Hoover Bldg.  
1401 Constitution Avenue, N.W.  
Washington, DC 20230

### 9.4 SECURITY CLASSIFICATION OF APPLICATIONS

1. Classified applications forwarded to NTIA in printed form shall contain all of the security information markings specified for documents in Executive Order 13526, dated December 29, 2009. These markings shall be applied as defined by 32 CFR, Part 2001.

2. Special Instructions for Secret Applications.

a. On applications which are classified SECRET:

(1) A statement should be inserted at a convenient place to the effect that reproduction by the FAS Secretary is authorized; however, this statement need not be included if the applicant has previously given the IRAC Executive Secretary written authority to reproduce classified documents. In those cases where the statement is inserted on an application, the statement shall not be included on electronically transmitted applications.

(2) The information that is classified SECRET shall be provided AFTER all other data are completed. An intervening statement preceding the SECRET data noting that the "THE FOLLOWING DATA, WHEN ASSOCIATED WITH THE FOREGOING DATA MAKES THE ENTIRE APPLICATION SECRET" must be included just prior to identifying the secret data.

(3) Information inserted in all other areas of the application shall be unclassified or classified CONFIDENTIAL.

b. As a minimum, for all SECRET applications that are to be considered by the FAS and subsequently recorded in the GMF, the following data items must be included in the CONFIDENTIAL or UNCLASSIFIED portion of the applications:

- (1) Agency Serial Number (entered on the COMMAND ENTRY).
- (2) Type of Action (TYP).
- (3) Security Classification (CLA).
- (4) Frequency (FRQ).
- (5) Missing Data Indicator (MSD).
- (6) Transmitter State/Country (XSC).

c. In addition to the minimum data fields noted in subparagraph 2b above, the following data items shall also be included in all CONFIDENTIAL portions for all SECRET applications:

- (1) Declassification Date (CDD).
- (2) Original Classification Authority (Circuit Remarks \*CLA); or,
- (3) Derivative Classification Authority (Circuit Remarks \*CLF).
- (4) Reason for Classification (Circuit Remarks \*CLR), if the Circuit Remarks \*CLA entry is included.
- (5) Classified Data Fields (Circuit Remarks \*CLC or \*CLS).
- (6) Unclassified Data Fields (Circuit Remarks \*CLU).
- (7) Extended Declassification Date (Circuit Remarks \*CDE), if a declassification year and month, or the declassification exemption category 25X1, is not entered in the field CDD.

- d. The Missing Data Indicator (MSD) shall contain the letter Z.
- e. The information that is classified SECRET shall not be entered on MODIFICATION, RENEWAL, and DELETION actions.
- f. SECRET applications will be distributed in accordance with Section 9.3.
- g. SECRET data shall not be included on magnetic discs.

## **9.5 REQUIRED JUSTIFICATION FOR A FREQUENCY ASSIGNMENT**

All federal agency frequency assignment requests must contain a justification of need statement and a general explanation of the operation. This statement must be provided by an FAS representative or a federal employee from the headquarters of the requesting agency. (see Section 9.8.2.80.k)

## **9.6 DESCRIPTION OF TYPES OF FREQUENCY ASSIGNMENTS**

### **9.6.1 Regular Assignment**

A REGULAR assignment is a frequency assignment for an unspecified period of time; however, the provisions of Section 8.2.6 apply.

### **9.6.2 (Reserved)**

### **9.6.3 Temporary Assignment**

1. A TEMPORARY assignment is made for a specified period of time not to exceed five years.
  - a. All assignments with experimental station classes are TEMPORARY assignments.
  - b. TEMPORARY assignments expire on the date shown in EXD.
  - c. TEMPORARY assignments may be renewed for additional periods as necessary.

(1) TEMPORARY assignment RENEWAL actions which are to be considered by the FAS shall be submitted at least one month prior to the Expiration Date (EXD) of the assignment.

2. When a TEMPORARY assignment is renewed or converted to a REGULAR assignment, the date of assignment for PRIORITY purposes shall be the original date from which continuous authorization has been in effect.

### **9.6.4 Trial Assignment**

1. A TRIAL assignment is a frequency assignment for the purpose of selecting a suitable SPECIFIC OPERATING FREQUENCY for REGULAR assignment.
  - a. TRIAL assignments shall be made whenever a trial:
    - (1) is considered necessary; or
    - (2) will provide a reasonable basis for judging harmful interference potentialities; or
    - (3) will resolve objections to a proposed REGULAR or TEMPORARY assignment which are based upon anticipated harmful interference.
  - b. TRIAL assignment operations MUST cease upon notice from the IRAC that harmful interference is being caused.
  - c. Objections based on PRIORITY shall not bar TRIAL assignments.
  - d. TRIAL assignments initially are not to exceed two years; however, a TRIAL assignment may be renewed for additional periods as necessary. The provisions of Section 9.6.3, paragraph 1.c.(1) applies. TRIAL assignments expire on the date shown in EXD.
2. Conversion from a TRIAL to a REGULAR assignment:
  - a. Before a TRIAL assignment is converted to a REGULAR assignment there shall have been adequate use of the frequency concerned and evidence thereof presented.
  - b. Additional limitations shall not be applied to an assignment at the conclusion of a trial period unless the trial develops the need for such limitations.
  - c. When a TRIAL assignment is converted to a REGULAR assignment, the applicable date of assignment for



PRIORITY purposes shall be the original date from which continuous authorization has been in effect.

### **9.6.5 Group Assignment**

1. A GROUP assignment is made only to terrestrial stations and:
  - a. provides authority to operate but does not represent continuing operations; or
  - b. provides an assignment for planning purposes.
2. GROUP assignments shall not be made to telemetering stations in the band 2200-2290 MHz.
3. GROUP assignments may be authorized as REGULAR, TEMPORARY, or TRIAL assignments.
4. There are two types of GROUP assignments:
  - a. The first type is one that PROVIDES AUTHORITY to operate but which does not represent continuing operations. The following applies to such assignments:
    - (1) Note S322 shall be entered in the NOTES (NTS) field. (see Annex A for S322 definition).
    - (2) The establishment of stations under the authority of these assignments shall be notified prior to or soon after the commencement of operations, except when the period of operation is so limited (on the order of six months or less) that notification would be impracticable (see Section 9.1.3).
  - b. The second type of GROUP assignment is one used for PLANNING PURPOSES and represents continuing or definitely anticipated requirements. The following applies to such assignments:
    - (1) Note S321 shall be entered in the NOTES (NTS) field. (see Annex A for S321 definition).
    - (2) Such assignments shall not exceed three years.
    - (3) The technical particulars of these assignments shall describe the intended use of the frequency to the maximum extent practicable at the time of application.
    - (4) Operations conducted under the authority of this type of GROUP assignment shall be limited to such uses as site surveys and path testing associated with the intended use. This type of GROUP assignment shall not be considered operational but strictly as a planning assignment set aside to satisfy an identified future requirement. However, all S321 assignments are accorded protection and may be coordinated with Canada at the option of the applicant.

## **9.7 FREQUENCY APPLICATION**

### **9.7.1 Uses of the Application Format**

1. The APPLICATION FORMAT is used for the following frequency assignment actions:
  - a. NEW (N)--To apply for a new frequency assignment, the particulars of which, when approved, will be entered in the GMF. See Section 9.8.2, paragraph 40 for special provisions when using a NEW action as a REPLACEMENT for an existing GMF record.
  - b. NOTIFICATION (F)--To notify the bringing into use of a frequency by stations under the authority of:
    - (1) Section 9.6.5, or
    - (2) Section 9.1.3, or
    - (3) Section 7.5.2, or
    - (4) Section 7.12, or
    - (5) Section 8.3.11.When approved, NOTIFICATION assignment particulars are also entered into the GMF. See Section 9.8.2, paragraph 40, for special provisions when using a NOTIFICATION action as a REPLACEMENT for an existing GMF record.
  - c. MODIFICATION (M)--To apply for the addition, substitution, or removal of one or more of the particulars, other than the Classification (CLA), the Frequency (FRQ), the Agency Serial Number (SER), or the Transmitter State/Country (XSC), of an existing frequency assignment. The following provisions apply:
    - (1) No more than 60 data fields of an assignment can be modified at one time.
    - (2) If more than 60 data fields require modification submit either a NEW or NOTIFICATION action using the record replacement feature described in Section 9.8.2, paragraph 40, or a simultaneous DELETION and NEW or NOTIFICATION action.
  - d. RENEWAL (R)--To apply for the extension of the period of a TEMPORARY or TRIAL assignment (see Section 9.6) and to simultaneously update other particulars of the assignment.
  - e. DELETION (D)--To apply for the cancellation of a frequency assignment and the removal of all its

particulars from the GMF.

## 9.7.2 Rules for the Use of the Application Format

1. Requests in the APPLICATION FORMAT may be submitted electronically or on magnetic disc. All individual data which are to be recorded in the GMF are submitted in accordance with the existing rules listed in Chapter 9.

2. Each request submitted in the APPLICATION FORMAT must contain two types of entries:

--COMMAND ENTRY; and  
--DATA ENTRIES.

3. The following formatting rules must be adhered to:

a. COMMAND ENTRY. The COMMAND ENTRY must always be the first entry. This entry consists of the application processing COMMAND and the RECORD IDENTIFIER (Agency Serial Number (SER)).

(1) The COMMAND is designated with one of three coded entries:

(a) \$\$ADD--for NEW and NOTIFICATION actions; or

(b) \$\$CHG--for MODIFICATION, RENEWAL, and DELETION actions.

(c) \$\$MOD--for use only with MODIFICATION actions in accordance with paragraph 9 below.

(2) The RECORD IDENTIFIER is ALWAYS the Agency Serial Number (SER) of the frequency assignment record.

(a) if \$\$ADD is used, the Agency Serial Number MUST be unique and MUST NOT already be recorded in the GMF.

(b) if \$\$CHG or \$\$MOD is used, the Agency Serial Number MUST be one which is recorded in the GMF.

*Example:* \$\$ADD AF 821234

b. DATA ENTRIES. DATA ENTRIES follow the COMMAND ENTRY. Each DATA ENTRY shall address only one data field and specify the:

(1) DATA FIELD MNEMONIC--a three letter code which identifies the data field being addressed. (See the Data Field Title line for each data field listed in Section 9.8.2).

(2) OCCURRENCE NUMBER--a two-digit number denoting which occurrence (first, second, etc.) of the field is being addressed, use a leading zero if necessary.

(3) REQUIRED DATA--submitted in accordance with specific instructions listed in Section 9.8.2.

(4) Generally, only those symbols allowed or specified in Section 9.8.2 shall be used as data. However, specifically, the following symbols shall not be used in any data field:

& -- And	: -- Colon	] -- Right square bracket
[ -- Left square bracket	@ -- At	# -- Number or pound
\ -- Reversed virgule	; -- Semicolon	? -- Question
< -- Less than	> -- Greater than	% -- Percent
! -- Exclamation	^ -- Insert (caret)	" -- Quotation
' -- Apostrophe	_ -- Underscore	

*Example:* FRQ01 M123.4

--the DATA FIELD MNEMONIC is: FRQ

--the OCCURRENCE NUMBER is: 01

--the REQUIRED DATA is: M123.4

4. Each application must contain one TYPE OF ACTION (TYP) data entry. The TYPE OF ACTION data entry must consist of one of the following:

N--for NEW actions

F--for NOTIFICATION actions

M--for MODIFICATION actions  
R--for RENEWAL actions  
D--for DELETION actions

5. Each application must also contain a preparation DATE (DAT) entry, which consists of the date in year, month, and day order; use leading zeros for the month and day as necessary.

*Example:* DAT01 820131

6. The following data fields are multiple occurring; the OCCURRENCE NUMBER must be 01 or greater, but must NOT exceed the maximum allowed for that field.

Table. Occurrence Number			
Codes	Max. Allowable Occurrences	Codes	Max. Allowable Occurrences
STC	20	RAZ	30
EMS	20	RAD	30
PWR	20	RAP	30
NTS	10	ACL	30
RSC	30	REM	30
RAL	30	SRS	09
RRC	30	SEX	09
RLA	30	SUP	15
RLG	30	FAS	05

7. All other data fields are single occurring. Only the number 01 following the mnemonic will be accepted.

8. \$\$CHG ACTIONS 0

a. \$\$CHG is used, along with the TYP data entry to identify a MODIFICATION, RENEWAL or DELETION action.

b. When submitting a MODIFICATION, RENEWAL or DELETION action, it is extremely important to accurately indicate the proper GMF data field and corresponding occurrence number which the applicant desires to modify. FAILURE TO ACCURATELY INDICATE THE PROPER GMF DATA FIELD AND CORRESPONDING OCCURRENCE NUMBER WILL RESULT IN AN INCORRECT CHANGE.

c. When submitting a MODIFICATION action, it is possible to add another occurrence of a multiple occurring field to an existing record; in effect, change BLANKS to DATA. The applicant must, however, address the next blank GMF occurrence of the data field(s) to be modified. For example, if a GMF record contains two station classes (STC), emissions (EMS), and power (PWR), and a third occurrence of each is necessary, the applicant submits:

```

$$CHG  FAA 723409
TYP01  M
DAT01  810901
EMS03  6KA3E
STC03  MA
PWR03  W10

```

9. \$\$MOD ACTIONS

a. Modifications may also be submitted using the COMMAND \$\$MOD. This optional procedure allows the applicant to submit both NEW and LISTED DATA in the same application, thus providing a means of comparison without having to refer to separate records. This procedure shall be used only with assignment records retrieved from the GMF in the card format, and re-submitted back to the NTIA/SSD via electronic transmission or on magnetic discs or tape

b. \$\$MOD actions require:

(1) Re-submission in Card Format;

(2) All new data be entered with an EQUAL SIGN (=) between the data field code occurrence number and

the data;

- (3) The Type of Action must always be entered as TYP01=M; and,
- (4) The date always be entered as DAT01=nnnnnn (date format is YYMMDD).

*Example:*

```
$$MOD A 810771
TYP01 M
DAT01 850828
CLA01 U
FRQ01 M168.625
BUR01 F3
STC01 MO
STC01 ML
EMS01 16K00F3E
PWR01 W5
PWR01 W25
NTS01 S362
NTS01 (in this case NEW data is blank -- deleting listed data)
TME01 1
TME01 3
XSC01 NM
XAL01 NEW MEXICO
XRC02 RGNLOFFC
RSC01 NM
RAL02 NEW MEXICO
REM01 *NRM, 00140,REGION 3 AIR OPS
REM01 *NRM, 00300,REGION 3 MOBILE OPS
REM02 *EQS,LMS
REM03 *SYS,NATURAL RESOURCES
SUP01 FOR PROTECTION OF NATIONAL FOREST LANDS
SUP01 WILDFIRE COMMUNICATIONS
```

10. Information for AGENCY USE, other than SECRET data, shall be provided after all other data are entered. The intervening statement FOR AGENCY USE must precede the data. The statement "FOR AGENCY USE" and subsequent data SHALL NEVER appear on magnetic disc or electronic submissions.

*Example:*

```
$$CHG AR 28306
TYP01 M
DAT01 791108
EMS03 6KA3E
RTN01 M
XSC01 VA
XAL01 NORFOLK
```

- 11. See Section 9.4, paragraph 2.b for rules on submission of SECRET data.
- 12. The following is a sample application.

```
$$ADD NTIA991234
TYP01 N
DAT01 850701
FRQ01M123.4
CLA01 U
```

NET01 AT013  
 ICI01 C  
 RTN01 R  
 BUR01 1A2A  
 EXD01 891215  
 STC01 FX  
 EMS01 16KF3E  
 PWR01 K1  
 STC02 FL  
 EMS02 16KF3E  
 PWR02 W100  
 NTS01 S361  
 NTS02 S362  
 XSC01 MD  
 XAL01 GLEN BURNIE  
 XLA01 392530N  
 XLG01 0764501W  
 XAP01 H  
 XAZ01 045  
 XCL01 AA 123  
 XAD01 03GDIPOLE 00050H0100T  
 TME01 1  
 RSC01 PA  
 RAL01 PHILADELPHIA  
 RRC01 DIV AX  
 RLA01 400201N  
 RLG01 0751502W  
 ACL01 WBW 22  
 RAP01 H  
 RAZ01 225  
 RAD01 10GHORN  
 RSC02 DE  
 RAL02 WILMINGTON AIRPORT  
 RLA02 395010N  
 RLG02 0753515W  
 ACL02 OLD341  
 RAP02 V  
 RAZ02 ND  
 RAD02 03GDIPOLE  
 REM01 \*RAD,0050R  
 REM02 \*NRM,00102,NET  
 SUP01 THIS IS A SAMPLE

## 9.8 PREPARATION OF A NEW OR NOTIFICATION ACTION

### 9.8.1 Introduction

Before submitting a NEW or NOTIFICATION action, read Section 9.7. The following index of data field codes, which are described in detail in Section 9.8.2, is provided for easy reference.

Table: Index of Field Codes					
Codes	Section 9.8.2 Paragraph No.	Codes	Section 9.8.2 Paragraph No.	Codes	Section 9.8.2 Paragraph No.
ACL	37	*CLR	39aa	*SBW	39t
BIN	11	*CDE	39bb	*SGN	39t

BUR	13	*CLC	39cc	*SYS	39u
CDD	7	*CLS	39cc	*TRN	39ee
CLA	6	*CLU	39dd	*USA	39w
DAT	3	*DOC	39g	RLA	33
EMS	16	*EBW	39t	RLG	34
EXD	14	*EGN	39t	RRC	32
FAS	79	*EQR	39o	RSC	30
FOI	41	*EQS	39o	RTN	4
FRQ	8	*EQT	39o	SER	1
ICI	10	*ESB	39e	SEX	40c
LSR	5	*ESR	39e	SPD	20
MSD	12	*EST	39e	SRS	40b
NET	9	*FRB	39b	STC	15
NTS	18	*FBE	39c	SUP	80
PWR	17	*FLN	39x	TME	19
RAD	38	*JNT	39i	TYP	2
RAL	31	*LSB	39e	XAD	29
RAP	35	*LSR	39e	XAL	22
RAZ	36	*LST	39e	XAP	26
REM	39	*MEX	39v	XAZ	27
*AGN	39j	*NRM	39m	XCL	28
*ARB	39f	*NTS	39k	XLA	24
*ARR	39f	*ORB	39q	XLG	25
*ART	39f	*PRD	39ff	XRC	23
*CAN	39l	*PRR	39n	XSC	21
*CLA	39y	*RAD	39d		
*CLF	39z	*RPT	39h		

## 9.8.2 Application Data Requirements

### 1. SER--Applicant Serial Number (10 Characters-1 Occurrence)

a. This field is for the applicant's Serial Number (SER) of the application. This serial number becomes the unique identifier for the application on the FAS agenda and for the assignment record, when approved, in the GMF. Once an application is on the FAS agenda, serial numbers MAY NOT be altered. The Serial Number must ALWAYS be entered on the COMMAND ENTRY which is ALWAYS \$\$ADD for a NEW or NOTIFICATION action, \$\$CHG for a MODIFICATION, RENEWAL, or DELETION action, or \$\$MOD for MODIFICATION action. Each application shall bear a unique 10 character Agency Serial Number composed of:

(1) The applicant's name abbreviation in characters 1-4; the abbreviation shall be the same as shown in Annex G, Section G.1. If the applicant's name abbreviation is less than 4 characters, leave characters 2-4 blank, as applicable.

(2) The last two digits of the current calendar year in characters five and six, and

(3) A four-digit number to indicate for that year and agency the numerical sequence of the proposed assignment action in characters 7-10.

b. Each year agencies must start a new cycle of Serial Numbers for new assignments. Agencies may start using the new year serial numbers on December 1 and must stop using the past years' serial numbers no later than January 31 (example: December 1, 2008 the Army could use AR 090001 and Army records with AR 08XXXX must be processed by NTIA onto an agenda by January 31, 2009). New assignments received by NTIA after January 31 with the previous year's serial numbers will be rejected.

c. On a joint application for a NEW action, insert the Serial Number for the agency that prepares the application. (Do not submit a joint application for a NOTIFICATION, MODIFICATION, RENEWAL or DELETION action.)

*Example:* AR 090001

### 2. TYP--Type of Action (1 Character--1 Occurrence)

Enter either the letter:

N--for a NEW action; or  
F--for a NOTIFICATION action.

### **3. DAT--Date (6 Characters--1 Occurrence)**

- a. Enter the date in year, month, and day order on which the application is prepared by the applicant.
- b. Use numeric characters only.
- c. Leave no blanks.

*Example:* DAT01 811225

### **4. RTN--Routine (1 Character--1 Occurrence)**

a. This field is used to indicate that the frequency application is to appear in the routine portion of the FAS agenda. Leave this field blank if the application is to appear in the regular portion of the FAS agenda. Only one of the letters A, or M or R may be entered in the RTN field.

b. Enter the letter:

- (1) A--if the assignment request is for consideration by the AAG (see Section 9.14.1), or
- (2) M--if the assignment request is for consideration by the MAG (see Section 9.14.2) or,
- (3) R--if the assignment request is not to be considered by the AAG or MAG and:
  - (a) the application is a notification of a telecommunication laser; or
  - (b) the assignment will be used during distress, safety and calling on frequency 156.8 MHz;or
  - (c) the assignment is being made pursuant to Section 7.12; or
  - (d) Note L192, L197, or L199 applies; or
  - (e) the assignment is made pursuant to Section 8.3.24; or
  - (f) the assignment will be for speed meter use on frequency 10525 MHz or 24150 MHz; or
  - (g) there will be no increase in the probability of harmful interference.

c. If the ROUTINE field is left blank or contains a character other than A, M or R, the application will appear in the regular portion of the agenda unless one of the following criteria is met:

(1) if the assignment request is to be considered by the AAG or MAG, the letter A or M, as applicable, will be automatically entered in the ROUTINE field; or

(2) if the assignment request:

- (a) is for 156.8 MHz; or
- (b) includes one or more of the following Notes (NTS):  
L192 S160  
L197 S279  
L199 S348

or,

(c) is for speed meter use on frequency 10525 MHz or 24150 MHz; or,

(d) is for the frequency band 401.7-402.1 MHz and includes the following Note (NTS): S594 the letter R will be automatically entered in the ROUTINE field.

### **5. LSR--List Serial Number (10 Characters--1 Occurrence)**

a. This field is to be used only on NOTIFICATION actions when an agency notifies the bringing into use of a frequency by a particular station or stations under the authority of an authorized GROUP assignment.

b. Insert the Serial Number of the GROUP assignment as it is shown in the GMF. Do not close up blank spaces which appear in characters 2-4 of the recorded GMF Agency Serial Number.

### **6. CLA--Classification (1 Character--1 Occurrence)**

a. This field is for the security classification of the assignment as determined in accordance with Executive Order 13526.

b. Insert only one of the following codes in this field. ASSIGNMENTS ARE NEVER CLASSIFIED HIGHER THAN SECRET.

(1) U--Unclassified (2) C--Confidential (3) S—Secret

c. Modification of the S--SECRET or C--CONFIDENTIAL classification (CLA) data field to U--UNCLASSIFIED is NOT authorized, EXCEPT by submission of a serial replace proposal.

## **7. CDD -- Declassification Date (6 Characters - 1 Occurrence)**

a. Complete this field for every application on which the CLA data field contains the letter C.

b. Enter the letters DE in the first two characters.

c. Beginning in character three,

(1) Enter the year and month of the declassification date, in year and month (YYMM) order (The assignment will be automatically declassified on the last day of that month.). (If the declassification date has been extended beyond 10 years from the initial classification date, an entry is also required in the Circuit Remarks field \*CLF); or,

(2) Enter the letter X, immediately followed by from one to three numbers, in numerical sequence, that correspond to the applicable exemption categories listed in Executive Order 13526; or,

(3) Enter 25X, immediately followed by a number that corresponds to the applicable exemption category listed in E.O. 13526. for those assignments that are exempt from the 25 year automatic declassification rule for permanently valuable information. (For all assignments not in the declassification exemption category 25X1, the date for declassification shall be included in the Circuit Remarks field \*CDE.); or,

(4) Enter OADR for those assignments that are classified derivatively based on source documents for which the declassification instructions are marked “Originating Agency’s Determination Required,” or its acronym “OADR”. An entry of OADR in this data field requires an entry in the Circuit Remarks field \*CLF.

(5) Enter DEVENT for those assignments that will be declassified after the occurrence of an event as specified in Executive Order 13526. An entry of DEVENT in this data field requires an entry in the Circuit Remarks field \*DIC.

*Examples:*

CDD01 DE0603

CDD01 DEX358

CDD01 DE25X1

CDD01 DEOADR

CDD01 DEVENT

## **8. FRQ--Frequency (13 Characters--1 Occurrence)**

Enter either a SPECIFIC OPERATING FREQUENCY (see paragraph 8.b.) or the lower limit of a FREQUENCY BAND ASSIGNMENT (see paragraph 8.c.) in accordance with the following instructions:

a. Composing the FRQ Entry

(1) In the first character enter one of the following codes to designate the category in which the frequency is being expressed:

K--for kiloHertz

M--for MegaHertz

G--for GigaHertz

T--for TeraHertz

Note: For frequencies expressed in kiloHertz, the applicant may optionally enter the letter K in character 1 or immediately begin entering the frequency in character 1 (see examples).

(2) Express the frequency in:

kiloHertz (kHz) thru 29999.999999 kHz,

MegaHertz (MHz) from 30 MHz thru 99999.999999 MHz,

GigaHertz (GHz) from 100 GHz thru 2999.999999 GHz, and

TeraHertz (THz) at 3 THz and above.

(3) Use a decimal point only if there is a significant (nonzero) digit to the right of the decimal.

(4) If a decimal point is used, enter no more than six significant digits to the right of the decimal.



b. Requesting SPECIFIC OPERATING FREQUENCIES

(1) A “SPECIFIC OPERATING FREQUENCY” (also referred to as “assigned frequency” or “authorized frequency”) identifies the center of that portion of the frequency spectrum occupied by the emitted signal. The lower and upper limits of the ASSIGNED FREQUENCY BAND, see Section 6.1.1, Paragraph 44, are determined by:

(a) Subtracting from the SPECIFIC OPERATING FREQUENCY one-half the necessary bandwidth shown in the Emission field plus the absolute value of the frequency tolerance as derived from Chapter 5; and

(b) Adding to the SPECIFIC OPERATING FREQUENCY one-half the necessary bandwidth plus the absolute value of the frequency tolerance as derived from Chapter 5.

The result of this calculation determines the amount of spectrum which may be occupied by a SPECIFIC OPERATING FREQUENCY.

(2) A SPECIFIC OPERATING FREQUENCY shall always be entered in the FRQ field unless the transmitting station employs one of the techniques described in paragraph 8.c. below.

*Examples:*

14495.5--for 14495.5 kHz, or  
K14495.5--for 14495.5 kHz  
M165.0125--for 165.0125 MHz  
G138.25--for 138.25 GHz

c. Requesting FREQUENCY BAND ASSIGNMENTS.

(1) Certain operations may necessitate the assignment of a range of frequencies in lieu of a specific operating frequency; this range is known as a “FREQUENCY BAND ASSIGNMENT.” FREQUENCY BAND ASSIGNMENTS permit the transmitting station to operate on any specific frequency so located within the range that the necessary bandwidth plus twice the tolerance does not extend beyond the lower and upper limits shown in the Circuit Remarks \*FRB field. See paragraph 8.b.(1) (a) and (b), for the method used to calculate the amount of spectrum which may be occupied by any specific emitted signal within the range of frequencies authorized by a FREQUENCY BAND ASSIGNMENT.

(2) Except as indicated in paragraph 8.c. (3), a FREQUENCY BAND ASSIGNMENT shall only be requested when one or more specific frequency assignments will not satisfy the requirement.

(3) FREQUENCY BAND ASSIGNMENTS are normally authorized only for the following:

(a) Transmitters which automatically sweep through all frequencies in a band.

(b) Radiosonde transmitters operating in either of the bands:

400.15-406.00 MHz

1670.00-1700.00 MHz

(c) Frequency agile radar beacons (racon) operating in either of the bands:

2900-3100 MHz

9300-9500 MHz

(d) Transmitters which use automatic frequency selection based upon changing propagation conditions along the transmission path.

(e) Transmitters which automatically pause at 15 or more specific operating frequencies within a band.

(f) Operations which require the use of 15 or more specific operating frequencies within a band for research, development, test and/or evaluation purposes.

(g) Operations which involve a multitude of mobile radiolocation or radionavigation transmitters. Whenever possible, at the option of the applicant, operational frequencies may be recorded in the CIRCUIT REMARKS \*AGN sub-field.

(h) Tactical and/or Training assignments above 30 MHz which require the use of 15 or more specific operating frequencies within a band.

(i) Operations devoted exclusively to electronic warfare (EW), electronic countermeasures (ECM), and/or electronic counter-countermeasures (ECCM).

(4) Requests for FREQUENCY BAND ASSIGNMENTS which do not meet the above criteria will be considered by the FAS on a case-by-case basis.

(5) Using the procedures in paragraph 8a, insert the frequency which identifies the lower limit of the

## FREQUENCY BAND ASSIGNMENTS.

(6) All applications for FREQUENCY BAND ASSIGNMENTS must include:

- (a) A dash in the Frequency Band Indicator (BIN) field, and
- (b) An entry in the Circuit Remarks \*FRB field.

d. Special Coordination Requirements.

(1) If the frequency requires coordination under the provisions of the Sections (as applicable) in Section 8.3 or Section 9.14, the applicant shall, insofar as practicable, complete such coordination prior to submitting the application to the FAS.

### **9. NET--Net Control (5 Characters--1 Occurrence)**

a. At the option of the applicant, this field may be used to identify within the applying agency:

- (1) A specific user; or
- (2) A command; or
- (3) An activity; or
- (4) A unit; or
- (5) A project; etc.

b. The data may be alpha, numeric or alphanumeric.

### **10. ICI--International Coordination Identifier (1 Character--1 Occurrence)**

a. When Canadian coordination is required by the IRAC in accordance with Section 3.4, enter the letter C in this field. The letter C should be entered on the application by the submitting agency; however, it will be entered by the Canadian Coordination computer program if this field is left blank and the application meets the criteria of Section 3.4.

b. When Canadian coordination is not required by the IRAC but the submitting agency determines it to be beneficial to coordinate with Canada, the submitting agency must enter the letter C in this field in order to initiate coordination action.

c. If the submitting agency desires Mexican coordination, enter the letter M in this field.

d. If both Canadian and Mexican coordination are desired, enter the letter B in this field.

e. When Canadian coordination is not required by Section 3.4 and neither Canadian nor Mexican coordination are desired, leave this field blank.

*Example:* ICI01 C

f. The ICI field is also used to identify the U.S. Federal Government coordination channels for those Canadian assignments along the U.S./Canada border that have been included in the GMF for electromagnetic compatibility analysis purposes:

D = through NTIA with FAS member agencies

F = through the FAA

J = through the DOD's Joint Chiefs of Staff (JCS)

U = no indication of coordination

g. When Canadian coordination is required by the FCC for the 932.5 - 935.0 or 941.5 - 944.0 MHz bands in accordance with Section 3.4, enter the letter A in this field. The letter A should be entered on the application by the submitting agency; however it will be entered by the Canadian Coordination computer program if this field is left blank and the application meets the criteria of Section 3.4.

### **11. BIN--Frequency Band Indicator (1 Character--1 Occurrence)**

a. Whenever a frequency band assignment is requested (see Section 9.8.2, paragraph 8.c.) enter a dash (-) in this field.

b. If a specific operating frequency is requested, leave this field blank.

*Example:* BIN01 --

### **12. MSD--Missing Data Indicator (1 Character-1 Occurrence)**

a. Enter the letter Z for all applications which would be classified SECRET if all required data were provided.

b. If the letter Z does not apply, leave this field blank.

*Example:* MSD01 Z

### **13. BUR--Bureau (4 Characters--1 Occurrence)**

- a. At the option of the applicant, this field may be used to identify an organizational subunit of the applying agency.
- b. If used, this field must contain an abbreviation from Annex G, Section G.1.

### **14. EXD--Expiration Date (6 Characters--1 Occurrence)**

- a. This field is for the year, month and day on which a TEMPORARY or TRIAL assignment is to expire (see Section 9.6)
- b. To compose the EXD entry:
  - (1) Insert in the first two characters the last two digits of the year; and
  - (2) Insert in characters three and four a two-digit number (01 through 12) for the month.
  - (3) Insert in characters five and six a two-digit number (01 to 31) corresponding to the day of the month the application is to expire.
- c. For TEMPORARY assignments the date shall not exceed five years.
- d. For TRIAL assignments, the date shall not exceed two years.
- e. For GROUP assignments used for planning purposes (NTS S321), the date shall not exceed three years.
- f. Leave blank for a REGULAR assignment.

*Example:* EXD01 890615

### **15. STC--Station Class (6 Characters--20 Occurrences)**

- a. This field is for the Station Class symbol(s) as shown in Sections 6.1.2 (alphabetical by classes) and 6.1.3 (alphabetical by symbols). Enter only one such symbol per entry.
- b. Each entry in the STATION CLASS field must also contain a corresponding entry in the POWER field and the EMISSION field.
- c. The suffix "R" shall be added to the class of station (STC) symbol only if the station is also a repeater station in a corresponding frequency assignment and its use is reflected in the paired frequency (PRD) field.

29.89-50.00 MHz	148.00-149.90 MHz	162.00-174.00 MHz
138.00-144.00 MHz	150.05-150.80 MHz	380.00-399.90 MHz
		406.10-420.00 MHz

For this purpose a repeater consists of a radio transmitter, a radio receiver and coupling between the two so as to retransmit unchanged in intelligence the received signal.

- d. The station class symbol FL shall be used only when all three land stations, land, maritime and aeronautical mobile, will be in use at some time (i.e., FL to be used only when all three classes, FB, FC, and FA will be used).
- e. The station class symbol MO shall be used when all three mobile stations, land, maritime and aeronautical mobile will be in use at some time (i.e., MO to be used only when all three classes, ML, MS, and MA, will be used).
- f. Each entry of the station class symbols: AM, AMA, MA, MAD, MAP, MO, MOE, MOEA, MOU operating in all frequency bands except those listed in paragraph g. below must also contain corresponding Circuit Remarks (REM) information on the maximum aircraft altitude (\*NTS,M014, 0030, see Section 9.8.2.39k) and commensurate authorized area of operation (\*RAD).
- g. Each entry of the station class symbol FA, FAC, FAB, FLU, MA, MAD, MAP, MO, MOE, MOEA, MOEB, MOU operating in the 118-136.475 MHz, 225-328.6 MHz, 335.4-399.9 MHz bands, Ground Based Transceiver Service (GBTS) using 978 MHz and 1090 MHz must also contain the corresponding Circuit Remarks (REM) Agency Data (\*AGN) information concerning the minimum altitude (FLL), maximum altitude (FLT) and Tailored Service Volume (TSV) as applicable to the assignment. (See Section 9.8.2.39 j)

### **16. EMS--Emission Designator (14 Characters--20 Occurrences)**

The EMISSION DESIGNATOR consists of the necessary bandwidth and emission classification symbols.

a. The amount of radio spectrum which may be occupied by an authorized frequency assignment does not extend beyond:

(1) The ASSIGNED FREQUENCY BAND (see Section 6.1.1) which is determined by:

(a) Subtracting from the specific operating frequency 1/2 the necessary bandwidth plus the absolute value of the frequency tolerance as derived from Chapter 5; and,

(b) Adding to the specific operating frequency 1/2 the necessary bandwidth plus the absolute value of the frequency tolerance as derived from Chapter 5; or

(2) The lower and upper limits shown in the Circuit Remarks \*FRB field for FREQUENCY BAND ASSIGNMENTS.

b. The authorized use is determined by the designated:

(1) Type of modulation;

(2) Nature of the signal(s) modulating the main carrier; and

(3) Type of information to be transmitted.

c. An EMISSION DESIGNATOR must be entered for each type of transmission. For example, a 6KA3E EMISSION DESIGNATOR does not include authority for any other type of transmission such as CW or tone modulated telegraphy.

d. The EMISSION DESIGNATOR consists of the following:

(1) Necessary bandwidth.

(a) See Annex J for methods used to calculate necessary bandwidths.

(b) Doppler Shift shall not be included in the frequency tolerance or necessary bandwidth; however, at the option of the applicant, Doppler Shift may be shown as an extra item of information in the SUPPLEMENTARY DETAILS field.

(2) Emission classification symbols:

(a) First symbol--Indicates the type of modulation of the main carrier.

(b) Second symbol--Indicates the nature of signal(s) modulating the main carrier.

(c) Third symbol--Indicates the type of information to be transmitted.

(d) Fourth symbol--Indicates the details of the signal (Optional--recommend when applicable).

(e) Fifth symbol--Indicates the nature of multiplexing (Optional--recommend when applicable).

e. The EMISSION DESIGNATOR shall be entered according to the following rules:

(1) Necessary Bandwidth. To express the necessary bandwidth portion of the EMISSION DESIGNATOR, enter a maximum of five numerals and one letter. The letter occupies the position of the decimal point and represents the unit of bandwidth as follows:

H for Hertz

K for kiloHertz

M for MegaHertz

G for GigaHertz

Fractional bandwidths may be expressed to a maximum of two decimal places following the letter. The first character of the necessary bandwidth shall always be greater than zero unless the necessary bandwidth is less than 1 Hertz in which case the first character shall be the letter H. Express the necessary bandwidths according to the following:

(a) Necessary bandwidths between .01 and 999.99 Hz shall be expressed in Hertz using the letter H in lieu of the decimal; (e.g., 15H is 15Hz of bandwidth; 15H01 is 15.01 Hz of bandwidth).

(b) Necessary bandwidths between 1.00 and 999.99 kHz shall be expressed in kiloHertz using the letter K in lieu of the decimal; (e.g., 2K is 2 kHz of bandwidth; 2K85 is 2.85 kHz of bandwidth).

(c) Necessary bandwidths between 1.00 and 999.99 MHz shall be expressed in MegaHertz using the letter M in lieu of the decimal; (e.g., 6M is 6 MHz of bandwidth; 6M25 is 6.25 MHz of bandwidth).

(d) Necessary bandwidths between 1.00 and 999.99 GHz shall be expressed in GigaHertz using the letter G in lieu of the decimal; (e.g., 10G is 10 GHz of bandwidth; 10G05 is 10.05 GHz of bandwidth).

(2) Emission Classification Symbols. Enter the basic emission designator of three symbols, and if desired, two optional additional symbols, as derived from the following:

(a) First symbol--designates the type of modulation of the main carrier:

<b>UNMODULATED</b>	
<b>Symbol</b>	<b>Type of Emission</b>
N	Emission of an unmodulated carrier.
<b>AMPLITUDE-MODULATED</b>	
Emission in which the main carrier is amplitude-modulated (including cases where sub-carriers are angle-modulated):	
A	Double-sideband
B	Independent sidebands
C	Vestigial sideband
H	Single-sideband, full carrier
J	Single-sideband, suppressed carrier
R	Single-sideband, reduced or variable level carrier
<b>ANGLE-MODULATED</b>	
Emission in which the main carrier is angle-modulated:	
<b>Symbol</b>	<b>Type of Emission</b>
F	Frequency modulation
G	Phase modulation
<b>AMPLITUDE-MODULATED AND ANGLE-MODULATED</b>	
<b>Symbol</b>	<b>Type of Emission</b>
D	Emission in which the main carrier is amplitude-modulated and angle-modulated either simultaneously or in a pre-established sequence.
<b>PULSE</b>	
Emission of pulses: (Emissions, where the main carrier is directly modulated by a signal which has been coded into quantized form (e.g., pulse code modulation), shall be designated as either an emission in which the main carrier is amplitude-modulated, or an emission in which the main carrier is angle-modulated).	
<b>Symbol</b>	<b>Type of Emission</b>
P	Sequence of unmodulated pulses.
A sequence of pulses:	
<b>Symbol</b>	<b>Type of Emission</b>
K	Modulated in amplitude
L	Modulated in width
M	Modulated in position
Q <sup>1</sup>	Carrier is angle-modulated during the period of the pulse
V	A combination of the foregoing or produced by other means

---

<sup>1</sup> Angle modulation includes either frequency or phase modulation.

<b>COMBINATION</b>	
<b>Symbol</b>	<b>Type of Emission</b>
W	Cases not covered above, in which an emission consists of the main carrier modulated, either simultaneously or in a combination of two or more of the following modes: amplitude, angle, pulse.
X <sup>2</sup>	Cases not otherwise covered.

(b) Second symbol--designates the nature of signal(s) modulating the main carrier:

<b>Symbol</b>	<b>Type of Emission</b>
0	No modulating signal.
1	A single channel containing quantized or digital signals without the use of a modulating subcarrier. (This excludes time-division multiplex.) <sup>3</sup>
2	A single channel containing a quantized or a digital signal with the use of modulating subcarrier. <sup>3</sup>
3	A single channel containing an analogue signal. <sup>3</sup>
7	Two or more channels containing quantized or digital signals. <sup>3</sup>
8	Two or more channels containing analogue signals. <sup>3</sup>
9	A composite system with one or more channels containing quantized or digital signals, together with one or more channels containing analogue signals.
X <sup>2</sup>	Cases not otherwise covered.

(c) Third symbol--designates the type of information to be transmitted (In this context the word “information” does not include information of a constant, unvarying nature such as provided by standard frequency emissions, continuous wave and pulse radars, etc.)

<b>Symbol</b>	<b>Type of Emission</b>
N	No information transmitted.
A	Telegraphy--for aural reception.
B	Telegraphy--for automatic reception.
C	Facsimile.
D	Data transmission, telemetry, telecommand; (the symbol D indicates that data, telemetry, or telecommand information is being transmitted individually or, that any combination of the three are being transmitted simultaneously. If any combination is being transmitted simultaneously, one of the multichannel symbols, 7, 8, or 9, must be used for the second symbol.)
E	Telephony (including sound broadcasting).
F	Television (video).
W	Combination of the above. (Use only for multi-channel systems having the capability of transmitting all information simultaneously).
X <sup>2</sup>	Cases not otherwise covered.

(d) Fourth symbol--designates the details of signal(s):

<sup>2</sup> The Supplementary Details (SUP) will provide a full explanation for the selection of the letter X unless the application is for a non-directional beacon in the bands 190-435 and 510-535 kHz.

<sup>3</sup> In this context, the word “Channel(s)” refers to the radio frequency (RF) channel.

Symbol	Type of Emission
A	Two-condition code with elements of differing numbers and/or durations.
B	Two-condition code with elements of the same number and duration without error-correction.
C	Two-condition code with elements of the same number and duration with error-correction.
D	Four-condition code in which each condition represents a signal element (of one or more bits).
E	Multi-condition code in which each condition represents a signal element (of one or more bits).
F	Multi-condition code in which each condition or combination of conditions represents a character.
G	Sound of broadcasting quality (monophonic).
H	Sound of broadcasting quality (stereophonic or quadrasonic).
J	Sound of commercial quality (excluding categories defined for symbols K and L below).
K	Sound of commercial quality with the use of frequency inversion or band-splitting.
L	Sound of commercial quality with separate frequency-modulated signals to control the level of demodulated signal.
M	Monochrome.
N	Color.
W	Combination of the above.
X <sup>2</sup>	Cases not otherwise covered.

(e) Fifth symbol--designates the nature of multiplexing:

Symbol	Type of Emission
N	None.
C	Code-division multiplex (This includes bandwidth expansion techniques.)
F	Frequency-division multiplex.
T	Time-division multiplex.
W	Combination of frequency-division multiplex and time-division multiplex.
X <sup>2</sup>	Other types of multiplexing.

*Examples:*

Symbol	Type of Emission
N0N	Continuous wave.
1K24F1B	1.24 kHz necessary bandwidth for frequency modulated single channel telegraphy.
16KF3EJN	16 kHz necessary bandwidth for commercial telephony.

f. Each entry in the EMISSION (EMS) field must also contain a corresponding entry in the POWER (PWR) and STATION CLASS (STC) fields.

## 17. PWR--Power (12 Characters--20 Occurrences)

a. This field is for the transmitter output power NORMALLY supplied to the antenna transmission line and is entered according to the emission designator as follows:

- (1) Carrier power (pZ) for A3E sound broadcasting in the Broadcasting Service.
- (2) Mean power (pY) for other amplitude modulated emissions using an unkeyed full carrier, and for all frequency modulated emissions.
- (3) Peak envelope power (pX) for all emission designators other than those referred to in (1) and (2) above, including C3F television (video only).

b. For different emission designators, the relationships between peak envelope, mean, and carrier power, under the conditions of normal operation and of no modulation, are contained in Recommendation ITU-R SM.326-6

(1994).

c. The power shall be entered as follows:

(1) In character one enter the unit of power as:

W-- for Watt

K -- for Kilowatt

M -- for Megawatt

G -- for Gigawatt

(a) Enter W and show power in watts when less than 1 kilowatt.

(b) Enter K and show power in kilowatts for 1 to 999.99999 kilowatts, inclusive.

(c) Enter M and show power in Megawatts for 1 to 999.99999 Megawatts, inclusive.

(d) Enter G and show power in Gigawatts when 1 Gigawatt and above.

(2) Insert a decimal point only if there is a significant nonzero value to the right of the decimal.

(3) The power may be entered to a maximum of five characters to the right of the decimal.

*Examples:* W.5 for 1/2 watt

K2.5 for 2 1/2 kilowatts

d. Each entry in the POWER (PWR) field must also contain a corresponding entry in the EMISSION (EMS) and STATION CLASS (STC) fields.

### **18. NTS--Record Notes (4 Characters--10 Occurrences)**

a. The RECORD NOTES apply to the entire frequency assignment; therefore, a specific RECORD NOTE shall be entered only once in this field. Agencies may enter RECORD NOTES as applicable during the preparation of applications, or RECORD NOTES may be added at the FAS meeting.

b. Enter, as applicable, the appropriate RECORD NOTE(S) from the lists shown in Annex A.

c. The types of RECORD NOTES which may be entered are:

(1) COORDINATION (C\_\_\_\_)--Indicates specific coordination requirements.

(2) EMISSION (E\_\_\_\_)--Indicates emission limitations.

(3) LIMITATION (L\_\_\_\_)--Indicates operational limitations.

(4) PRIORITY (P\_\_\_\_)--Indicates assignment precedence in relation to other assignments.

(5) SPECIAL (S\_\_\_\_)--Indicates special conditions and/or amplifying data.

d. All assignment requests meeting one or more of the following criteria must indicate the applicable NOTE(S):

(1) For a station in the domestic FIXED service (see Section 8.2.11), enter, as appropriate:

C078	L012	S012	S148	S206
S208	S358	S359	S360	

(2) Enter the applicable NOTE(S) from the S500-S899 series if the assignment is for:

(a) A station in a Space radiocommunication service; or

(b) An experimental station to be operated in the manner of a station in a Space radiocommunication service; or

(c) An experimental station to be used for the static test (prelaunch ground-to-ground checkout) of communication equipment to be used in a Space radiocommunication service; or

(d) A station to be used to support a Space mission.

(3) Enter S321 or S322 for an assignment being made that is subject to the provisions of Section 9.6.5.

(4) Enter S348 if an assignment is for communications with Non-Federal Citizens Band (CB) stations and is made pursuant to Section 8.3.24.

e. For NOTIFICATION actions:

(1) Enter S160 or S165 if the assignment is being made under the authority of Section 7.12 or Section 7.5.2.



(2) Enter S141 if the assignment is to a transmitting station located outside the US&P.

(3) Enter the NOTES which were applied to the GROUP assignment (see Section 9.6.5); except that NOTES S149, S321, and S322 shall never be entered on the NOTIFICATION action. If the GROUP assignment bears either S170 or S171, these NOTES may be inserted or omitted at the option of the applicant.

f. Enter the NOTE S366 on applications for an area assignment whose parameters indicate that operations are outside the Canadian Zone but are suspect of Canadian Coordination or when:

(1) The parameters provided on the application meet the requirements for Canadian coordination as specified in Section 3.4; and

(2) The Transmitter Antenna Location (XAL) field contains an area that is within or partially within the U.S./Canadian Coordination Zone (see Section 3.4); and

(3) The Transmitter Antenna Latitude and Longitude (XLA and XLG) fields are blank on the application; but

(4) Operations will be south of the U.S./Canada Coordination Zone; or

(5) For frequencies below 1000 MHz the power used while in the Zone will not exceed 5 watts.

### **19. TME--Time (4 Characters--1 Occurrence)**

a. This field is for the period of time during which it is intended that the frequency will be either guarded (monitored) or used for transmission. The period indicated is not a limitation or restriction, but rather the normal period of time during which the frequency is required to satisfy the operational requirement described in supplementary details.

b. This field applies to assignments in all bands except for assignments containing either of the Notes S141, S321, S322 or S323. Prior to January 5, 2015, TME will be reviewed, added, or modified for assignments contained in the five quantitative assessment frequency bands: 1300-1390 MHz, 1675-1695 MHz, 2700-2900 MHz, 2900-3100 MHz, and 3100-3550 MHz. All other frequency assignments will be reviewed, added, or modified during their appropriate 5 year review.

c. The period of time shall be indicated by use of one of the numbers 1 through 4, entered in the first character of the TIME (TME) field as follows, enter the number:

1--For constant or nearly (50-100% use); or

2--For regular or frequent (10-50% use); or

3--For intermittent (1-10% use); or

4--For sporadic/occasional (less than 1% use).

d. In all bands below 29.89 MHz, this field may also be used to indicate the period of the day that a circuit is in operation. Enter one of the following, as applicable:

H24--For 24-hour operation,

HJ--For day operation,

HN--For night operation,

HT--For transition period operation,

HX--For intermittent operation throughout the 24-hour day or no specific working hours.

Note that this entry applies to the period of operation of the circuit, not the period of operation of an individual frequency. If one of these symbols is entered in this field with one of the figures 1 through 4, the applicable figure is entered first.

### **20. SPD--Power Density (4 Characters--1 Occurrence)**

a. On applications for assignments to earth or space stations, or to terrestrial stations (including experimental stations) employing earth or space station techniques, insert the maximum power density (in dB(W/Hz)) supplied to the antenna. For frequencies below 15 GHz, the power shall be averaged over the worst 4 kHz band; for frequencies at 15 GHz and above, the power shall be averaged over the worst 1 MHz band. The worst 4 kHz or 1 MHz band are defined as that 4 kHz or 1 MHz that has the highest power density within the assigned necessary bandwidth.

b. For negative values insert a dash in character one.

c. For positive values insert a zero in character one.

d. For values less than 10, insert a zero in characters two and three.

e. For values 10 to 99 inclusive, insert a zero in character two.

*Examples:* SPD01 –008 (The maximum power density per Hertz is –8 dBW/Hz.)  
SPD01 0001 (The maximum power density per Hertz is 1 dBW/Hz.)

## **21. XSC--Transmitter State/Country (4 Characters--1 Occurrence)**

- a. Using one of the geographical abbreviations (State, Country, or Area) as shown in Annex G, Section G.2, insert the abbreviation of the State, Country, or Area in which the site of the transmitting station is located.
- b. If the State, Country, or Area in which the site of the transmitting station is located is classified SECRET, insert XXXX in this field.
- c. For a station on board a satellite in space, insert SPCE.
- d. For emanations from a natural or cosmic origin intended for reception by space-based Passive Sensor or Radio Astronomy stations, insert RCVR.

*Example:* XSC01 CO for Colorado

## **22. XAL--Transmitter Antenna Location (24 Characters--1 Occurrence)**

- a. This field is for the name of the city or other geographical subdivision in which the site of the transmitting antenna is physically located. A major installation, such as Dallas-Fort Worth International Airport or Andrews AFB, is considered to be a city or other geographical subdivision. In certain cases non-geographical data are used.
- b. In certain cases it may be necessary to describe an area of operation for which no specific name can be applied. For locations described as an area of operation, it shall be recognized that transmissions might not occur in every square kilometer of the area indicated, and the area described might overlap into states that are not shown in the transmitter STATE/ COUNTRY field.
- c. Such areas may be described:
  - (1) as a radius in kilometers extending from a given location;

*Example:*

In the case of transmissions by one or more mobile stations located at any point within 80 kilometers of Dallas, insert DALLAS in this field and a radius in the CIRCUIT REMARKS \*RAD field; or

- (2) by the use of geographical coordinates in Circuit Remarks.

*Example:*

In the case of transmissions by one or more mobile stations in the area south of 33 degrees N in the State of Arizona, insert Arizona in this field and the data pertaining to the coordinates in the CIRCUIT REMARKS field. An area of operation within several states also may be described in this field as US or USA with the included or excluded states being shown in the CIRCUIT REMARKS field. Similarly, USP may be used if the area includes a possession.

d. While the data inserted normally shall be geographical names or descriptions, exceptions may be made for experimental operations, mobile operations where the XSC and XAL fields are identical, or for space operations. The following rules apply:

- (1) For transmission by an experimental station, other than one in space, or to a mobile station having identical XSC and XAL fields, words such as AIRCRAFT, BALLOONS, or SHIPS may be used as appropriate.
- (2) For transmission by a station aboard a geostationary satellite, insert GEOSTATIONARY.
- (3) For transmission by a station aboard a nongeostationary satellite, insert NONGEOSTATIONARY.
- (4) For transmission by a station located on a natural object in space, insert the name of the object, e.g., MOON.
- (5) For transmission by a station aboard a space vehicle designed for operation in deep space (beyond the moon) where Earth orbital data are irrelevant, insert DEEP SPACE followed by planet (s) name, or PROBE, for those vehicles that do not orbit other planetary objects.
- (6) For emanations from a natural or cosmic origin intended for reception by a space-based Passive Sensor (station class E2 or E4 and note S385) or Radio Astronomy stations (station class RA and note S385), insert RCVR.
- (7) For transmission by a station aboard a vehicle whose purpose is to carry a payload into orbit, transmissions could occur from launch through placing the payload into orbit, the term LAUNCH VEHICLE may

be used.

- e. Entries in this field are limited to ALPHA and NUMERIC characters.

### **23. XRC--Transmitter Control (8 Characters--1 Occurrence)**

This field is optional and is primarily for the name of the facility that controls, either electrically or administratively, the transmitting station; however, other similar data may be inserted. If the name exceeds eight characters, abbreviate.

### **24. XLA--Transmitter Antenna Latitude (7 Characters 1 Occurrence)**

a. Insert two characters each for the degrees, minutes, and seconds of the latitude of the site named in the TRANSMITTER ANTENNA LOCATION (XAL) field. Insert leading zeros for degrees, minutes, and seconds as required. Seconds shall be provided whenever possible; however, if it is impracticable to obtain the exact seconds, insert the closest seconds available. Coordinates will be referenced to the World Geodetic System Code 84/North American Datum 83. If another system code is used the type and reason will be entered in the supplementary remarks section.

b. Leave this field blank if:

(1) The site named in the TRANSMITTER ANTENNA LOCATION (XAL) field is an area, see Section 9.8.2, paragraph 22.c.(2) for which coordinates cannot be applied, e.g., Chicago District; or,

(2) If non-geographical data are used, e.g., AIRCRAFT.

c. For a station aboard a Geostationary satellite, insert 000000N.

d. For a station aboard a Non-geostationary satellite or a Deep Space vehicle, leave this field blank.

e. Insert N for North or S for South latitude in the last space as applicable.

*Example:* XLA01 385351N

### **25. XLG--Transmitter Antenna Longitude (8 Characters--1 Occurrence)**

a. Insert in degrees (three characters), minutes (two characters) and seconds (two characters), the longitude of the site named in the TRANSMITTER ANTENNA LOCATION (XAL) field. Insert leading zeros for degrees, minutes, and seconds as required. Seconds shall be provided whenever possible; however, if it is impracticable to obtain the exact seconds, insert the closest seconds available. Coordinates will be referenced to the World Geodetic System Code 84/North American Datum 83. If another system code is used the type and reason will be entered in the supplementary remarks section.

b. Leave this field blank if:

(1) The site named in the TRANSMITTER ANTENNA LOCATION (XAL) field is an area for which coordinates cannot be applied, e.g., Chicago District; or,

(2) If non-geographical data are used, e.g., AIRCRAFT.

c. For a station aboard a Geostationary satellite, insert the longitudinal position of the satellite in degrees (three characters) and minutes (two characters) East or West longitude. In this case always enter 00 in the seconds portion of this field. Use leading zeros as required.

d. For a station aboard a Non-geostationary satellite, or a Deep Space vehicle, leave this field blank.

e. Insert E for East or W for West longitude in the last space as applicable.

*Example:* XLG01 0770133W

### **26. XAP--Transmitter Antenna Polarization (3 Characters--1 Occurrence)**

a. Transmitter antenna polarization is required on applications:

(1) For assignments above 1000 MHz that must be coordinated by the IRAC with the Canadian Department of Communications pursuant to Section 3.4.6, Appendices 3 and 4 of Arrangement D; or

(2) For transmitting Earth or Terrestrial stations (including experimental stations) employing Earth station techniques; or

(3) For transmitting Space or Terrestrial stations (including experimental stations) using Space station techniques;

(4) For assignments to TERRESTRIAL STATIONS at 420 MHz and above.

b. Transmitter Antenna Polarization is not required on applications for:

- (1) Experimental stations except as indicated in 26.a.(2) and (3);
- (2) Mobile stations;
- (3) Portable stations;
- (4) Radiolocation mobile stations;
- (5) Radionavigation mobile stations;
- (6) Transportable stations;
- (7) Group assignments;
- (8) A period of six months or less;
- (9) Meteorological Aids in the 1660-1700 MHz band;
- (10) TACAN/DME stations in the 960-1215 MHz band;
- (11) Aeronautical Telemetry stations in the 1435-1535, 2200-2290 and 2310-2395 MHz bands.

c. This field may be completed on other applications at the option of the applicant.

d. If more than one antenna is to be used, insert the polarization of the antenna to be used most frequently; however, for a space station, antenna polarization may be listed for up to three antennas, provided they are entered in the same sequence as the antenna data entered in the TRANSMITTER ANTENNA DIMENSIONS (XAD) field.

e. Insert one of the following letters or combination of letters to indicate the antenna(s) polarization:

- A--Elliptic, Left
- B--Elliptic, Right
- D--Rotating
- E--Elliptical
- F--45 degrees
- H--Horizontal
- J--Linear
- L--Left Hand Circular
- M--Oblique Angled, Left
- N--Oblique Angled, Right
- O--Oblique Angled, Crossed
- R--Right Hand Circular
- S--Horizontal and Vertical
- T--Right and Left Hand Circular
- V--Vertical
- X--Other

*Examples:* XAP01 V (Vertically polarized transmissions)

XAP01 FJL (45 degrees, Linear, and Left Hand Circular polarized transmissions for three space station antennas)

## **27. XAZ--Transmitter Antenna Orientation (3 Characters--1 Occurrence)**

a. TERRESTRIAL STATIONS: On applications for assignments to Terrestrial stations complete this field in accordance with the procedures given below for the applicable frequency range. Enter one of the following as applicable:

(1) For directive antennas oriented in a fixed direction, enter a three-digit number indicating the azimuth of the main antenna lobe in degrees east of True North, using leading zeros as necessary and 360 for True North.

(2) For stations using on-site passive reflectors, displaced vertically from the primary antenna or installed on the same antenna farm as the primary antenna (normally within 150 meters of the transmitter), enter the horizontal azimuth of the on-site passive reflector.

(3) S--For directive antennas that operate in fixed mode (direction) but are steerable in the horizontal plane, e.g., steerable log periodic.

(4) ND--For Non-directive antennas.

(5) R--For antennas rotating through a full 360 degree azimuth while in operation.

(6) SSH--For antennas scanning horizontally through a limited sector.

(7) SSV--For vertically scanning (nodding) antennas.

(8) T--For tracking antennas capable of continuous reorientation for the purpose of maintaining optimum observance of a moving station or object.

b. TERRESTRIAL STATIONS BELOW 29890 kHz

(1) On applications for assignments to fixed (FX) stations in the band 3000 to 29890 kHz, enter the appropriate code in accordance with paragraph 27a.(1)-(8). This field may be left blank if the ANTENNA LOCATION is an area representing multiple transmitting stations, e.g., Chicago District, or if the application bears either the Note S362 or S189.

(2) On applications for assignments below 29890 kHz, other than those for fixed (FX) stations in the band 3000 to 29890 kHz, this field may be completed at the option of the applicant in accordance with paragraph 27a.(1)-(8).

**c. TERRESTRIAL STATIONS AT 29890 kHz AND ABOVE**

(1) On applications for assignments to stations at 29890 kHz and above, enter the appropriate code in accordance with 27a.(1)-(8).

(2) This field may be left blank on applications for:

- (a) Experimental stations;
- (b) Mobile stations;
- (c) Portable stations;
- (d) Radiolocation mobile stations;
- (e) Radionavigation mobile stations;
- (f) Transportable stations;
- (g) Group assignments;
- (h) A period of six months or less;
- (i) Marker beacons in the 74.8-75.2 MHz band;
- (j) VOR/ILS in the 108-117.975 MHz band;
- (k) Stations in the aeronautical mobile service in the 117.975-136 MHz band;
- (l) Stations in the aeronautical and maritime mobile services in the 138-144, 148-150.8, 157.0375-157.1875, 225-328.6, 335.4-399.9 MHz bands, or on the frequencies 156.6, 156.7, 161.6 MHz;
- (m) Glideslopes in the 328.6-335.4 MHz band;
- (n) Meteorological Aids in the 400.05-406, and 1660-1700 MHz bands;
- (o) TACAN/DME in the 960-1215 MHz band; and
- (p) Aeronautical telemetering stations in the 1435-1535, 2200-2290 and 2310-2395 MHz bands; and
- (q) Stations using radar.

(3) On applications for assignments that are listed above as exceptions, this field may be completed at the option of the applicant.

**d. EARTH STATIONS:** For Earth and Terrestrial stations (including experimental stations) employing Earth station techniques, insert the letter V followed by a two-digit number expressing the minimum operating angle of elevation of the antenna, in degrees, from the horizontal for geostationary satellites and the minimum operating angle of elevation of the antenna, in degrees, from the horizontal for non-geostationary satellites and multiple receiving geostationary satellites.

**e. SPACE STATIONS:** For Space and Terrestrial stations (including experimental stations) employing space station techniques, enter one of the following, whichever is applicable.

- (1) NB--for narrow beam antennas, i.e., substantially less than earth coverage; or
- (2) EC--for earth coverage antennas; or
- (3) Leave the field blank in the case of space-to-space operations.

**28. XCL--Transmitter Call Sign (8 Characters-1 Occurrence)**

This field is for the call sign or identifier assigned to the station in accordance with Section 6.5.

a. Insert the full call sign starting in the first position left-justified; however, those that do not require eight spaces and that are formed by letters followed by numbers, insert the letters with left-justified and the numbers with right-justified.

b. For navigation aids this field is for the identifier instead of a call sign.

*Example: XCL01 WUH 55*

**29. XAD--Transmitter Antenna Dimensions (24 Characters--1 Occurrence)**

This field shall be completed in accordance with the following procedures. Each Entry is dependent upon

frequency range and type of station, i.e., TERRESTRIAL, EARTH or SPACE. Antenna gain must be entered in decibels with reference to an isotropic (dBi) source. Where gain is derived from a source in reference to a dipole (dBd), the dBi gain can be determined by adding 2.15 to the dBd gain ( $\text{dBd} + 2.15 = \text{dBi}$ ) (ref: ITT Reference Data for Radio Engineers). Enter data according to the following:

a. TERRESTRIAL Stations BELOW 29890 kHz:

(1) This field may be left blank if the ANTENNA LOCATION (XAL) is an area representing multiple transmitting stations, e.g., Chicago District, or if the application bears either of the Notes S362 or S189.

(2) Gain is required on applications for assignments to fixed (FX) stations in the band 3000 to 29890 kHz. Only the gain shall be entered in characters 1-3 of this field. Characters 4-24 shall be blank. The following formatting instructions apply: Insert in characters one and two, an appropriate two digit number which represents the gain; use a leading zero if the gain is less than ten. Insert the letter G in the third character (e.g., 04G, 20G). If the gain is zero it shall be entered as 00G.

(3) On all other applications for assignments below 29890 kHz, this field may be completed at the option of the applicant. However, if completed it must be in accordance with (2) above.

b. TERRESTRIAL Stations at 29890 kHz and ABOVE:

(1) This field may be left blank on applications for:

- (a) Experimental stations;
- (b) Mobile stations;
- (c) Portable stations;
- (d) Radiolocation mobile stations;
- (e) Radionavigation mobile stations;
- (f) Transportable stations;
- (g) Group assignments;
- (h) A period of six months or less;
- (i) Marker beacons in the 74.8-75.2 MHz band;
- (j) VOR/ILS in the 108-117.975 MHz band;
- (k) Stations in the aeronautical mobile service in the 117.975-136 MHz band;
- (l) Stations in the aeronautical and maritime mobile service in the 138-144, 148-150.8, 157.0375-157.1875, 225-328.6, 335.4-399.9 MHz bands, or on the frequencies 156.6, 156.7, 161.6 MHz;
- (m) Glideslopes in the 328.6-335.4 MHz band;
- (n) Meteorological aids in the 400.05-406, and 1660-1700 MHz bands;
- (o) TACAN/DME in the 960-1215 MHz band;
- (p) Aeronautical telemetering stations in the 1435-1535, 2200-2290, and 2310-2395 MHz bands.

(2) On all applications for assignments above 29890 kHz that are listed in 29b.(1)(a)-(p) as exceptions, this field may be completed at the option of the applicant.

(3) If more than one antenna is to be used, insert the data for the antenna to be used most frequently.

(4) The following formatting instructions apply:

(a) GAIN--Insert in the first two characters a two-digit number representing the nominal gain of the antenna in decibels. Insert a zero in the first space if the gain is less than ten. Enter the letter G in the third space. If the gain is zero, enter 00G.

(b) NAME--Starting with the fourth character, insert an abbreviation from the list of approved antenna names and the associated authorized abbreviations listed in Annex G, G.6. If the antenna is not listed, forward the new antenna name, abbreviation, and manufacturer specification sheet to the FAS for inclusion into Annex G, G.6 prior to submitting proposals.

(c) ELEVATION--Starting with the 14th character, enter a five-digit number representing the site (terrain) elevation in meters above mean sea level (MSL). Use all five spaces, inserting leading zeros as applicable. For a site below MSL, enter a dash in the 14th space and a four digit number. Insert the letter H in the 19th space. Leave blank for assignments to transportable transmitter stations (S362).

(d) HEIGHT--Starting with the 20th character, insert a four-digit number representing the antenna height in meters above terrain. Use all four spaces, inserting leading zeros as applicable. Insert the letter T in the 24th space.

*Example:* XAD01 10GCORNREFLTR06550H0175T

c. EARTH Stations: The following formatting instructions apply to both Earth and Terrestrial stations (including experimental stations) employing Earth station techniques.

(1) Use the entire 24 characters to record the following particulars:

(a) GAIN--Insert in the first two characters a two-digit number representing the gain of the antenna in the direction of maximum radiation. Insert a zero in the first character if the gain is less than ten. Enter the letter G in character three. For a negative gain, insert XXG and give the value in the CIRCUIT REMARKS \*EGN field.

(b) BEAMWIDTH--Beginning with character four, insert a three-digit number representing the antenna beamwidth (degrees) at the half power points. Use all three spaces, inserting leading zeros as applicable. Enter the letter B in character seven. For a beamwidth requiring more than three spaces, insert XXXB and give the value in the CIRCUIT REMARKS \*EBW field.

(c) AZIMUTH--In characters eight through fourteen, insert the azimuth angles (in degrees clockwise from True North) of the main beam. If the Earth station is to communicate with a single Geostationary satellite, insert the azimuth angle to the satellite in spaces eight through ten (use leading zeros), a slant bar in space eleven, and XXX in spaces twelve through fourteen. If it is to communicate with two geostationary satellites, insert the azimuth angle to the first in spaces eight through ten, a slant bar in space eleven, and the azimuth angle to the second satellite in spaces twelve through fourteen. If the Earth station is mobile or transportable, or is to communicate with nongeostationary satellites or with more than two geostationary satellites, indicate the range of azimuth angles over which the Earth station antenna will point by inserting in spaces eight through ten a three-digit number for one extreme azimuth, a hyphen in space eleven, and a three-digit number in spaces twelve through fourteen for the other extreme azimuth. Use leading zeros as necessary and 360 for True North. In character fifteen insert the letter A.

(d) ELEVATION--Starting with character sixteen, insert a five-digit number representing the site (terrain) elevation in meters above mean sea level (MSL). Use all five spaces, inserting leading zeros as necessary. In character twenty-one insert the letter H.

For mobile or transportable stations, leave blank.

(e) HEIGHT--Starting with character twenty-two, insert a three-digit number representing the antenna height in meters above terrain. Use all three spaces, inserting leading zeros as applicable. For an Earth station aboard an aircraft, insert a two-digit number followed by the letter K to denote the maximum operational altitude of the aircraft in thousands of feet above mean sea level.

For altitudes under 10,000 feet insert a leading zero.

*Example:* XAD01 35G106B010/130A05200H025

d. SPACE Stations: The following formatting instructions apply to both Space and Terrestrial stations (including experimental stations) using Space station techniques:

(1) This field provides room for the details of up to three antennas per Space station. If the station uses more than three antennas for the requested frequency, provide data for the three most frequently used antennas.

(2) Use characters one through seven for the details of the first antenna. Enter:

(a) GAIN--Insert in the first two characters a two-digit number representing the gain of the antenna in the direction of maximum radiation. Insert a zero in the first character if the gain is less than ten. Enter the letter G in character 3. For a negative gain, insert XXG and give the value in the CIRCUIT REMARKS \*SGN field.

(b) BEAMWIDTH--Beginning with character four, insert a three-digit number representing the antenna beamwidth (degrees) at the half power points. Use all three spaces, inserting leading zeros as necessary. Insert the letter B in space seven. For a beamwidth requiring more than three spaces, insert XXXB and give the value in the CIRCUIT REMARKS \*SBW field.

*Examples:*

XAD01 08G150B  
XAD01 36G2.1B  
XAD01 XXG125B  
XAD01 20GXXXB

(3) If the assignment involves the use of a second antenna:

(a) Insert a slant bar in character eight; and,

(b) Use characters nine through fifteen for the details as specified in paragraph 29.d.(2)(a)

and (b).

*Example:* XAD01 30G016B/30G0.1B

(4) If the assignment involves the use of a third antenna:

(a) Insert a slant bar in character sixteen; and,

(b) Use characters seventeen through twenty-three for the details of the third antenna as specified in paragraph 29.d.(2) (a) and (b).

*Example:* XAD01 30G016B/30G0.1B/20G.25B

(5) Leave character twenty-four blank.

### **30. RSC--Receiver State/Country (4 Characters--30 Occurrences)**

a. Using one of the geographical abbreviations (state, country, or area) as shown in Annex G, Section G.2, insert the abbreviation of the State, Country, or Area in which the site of the receiving station is located.

b. For a station on board a satellite in space, insert SPCE.

*Example:* RSC01 CO for Colorado.

### **31. RAL--Receiver Antenna Location (24 Characters--30 Occurrences)**

a. This field is for the name of the city or other geographical subdivision in which the site of the receiving antenna is physically located. A major installation, such as Fort Monmouth or Andrews AFB, is considered to be a city or other geographical subdivision. In certain cases non-geographical data are used.

b. In certain cases it may be necessary to describe an area of operation for which no specific name can be applied. For locations described as an area of operation, it shall be recognized that reception might not occur in every square kilometer of the area indicated, and the area described might overlap into States that are not shown in the RECEIVER STATE/COUNTRY (RSC) field.

c. Such areas may be described:

(1) As a radius in kilometers extending from a given location:

*Example:*

In the case of reception by one or more mobile stations located at any point within 80 kilometers of Dallas, insert DALLAS in this field and a radius in the CIRCUIT REMARKS \*RAD field; or

(2) By the use of geographical coordinates in Circuit Remarks.

*Example:*

In the case of reception by one or more mobile stations in the area south of 33 degrees N in the State of Arizona, insert Arizona in this field and the data pertaining to the coordinates in the CIRCUIT REMARKS field. An area of operation within several States also may be described in this field as US or USA with the included or excluded States being shown in the CIRCUIT REMARKS field. Similarly, USP may be used if the area includes a Possession.

d. While the data inserted normally shall be geographical names or descriptions, exceptions may be made for experimental operations, mobile operations where the RSC and RAL fields are identical, or for space operations. The following rules apply:

(1) For reception by an experimental station, other than one in space, or to a mobile station having identical RSC and RAL fields, words such as AIRCRAFT, BALLOONS, or SHIPS may be used as appropriate.

(2) For reception by a station aboard a geostationary satellite, insert GEOSTATIONARY.

(3) For reception by a station aboard a non-geostationary satellite, insert NONGEOSTATIONARY.

(4) For reception by a station located on a natural object in space, insert the name of the object, e.g., MOON.

(5) For reception by a station aboard a space vehicle designed for operation in deep space (beyond the moon) where earth orbital data are irrelevant, insert DEEP SPACE followed by planet(s) name, or PROBE, for those vehicles that do not orbit other planetary objects.

e. Entries in this field are limited to ALPHA and NUMERIC characters.



### **32. RRC--Receiver Control (8 Characters--30 Occurrences)**

This field will only be used by the computer program Federal Spectrum Management System (FSMS)/Spectrum XXI online to indicate that the GMF record has been processed through the new system. Agencies cannot enter data into this field.

### **33. RLA--Receiver Antenna Latitude (7 Characters--30 Occurrences)**

a. Insert two characters each for the degrees, minutes, and seconds of the latitude of the site named in the RECEIVER ANTENNA LOCATION (RAL) field. Insert leading zeros for degrees, minutes, and seconds as required. Seconds shall be provided whenever possible; however, if it is impracticable to obtain the exact seconds, insert the closest seconds available. Coordinates will be referenced to the World Geodetic System Code 84/North American Datum 83. If another system code is used the type and reason will be entered in the supplementary remarks section.

b. Leave this field blank if:

(1) The site named in the RECEIVER ANTENNA LOCATION (RAL) field is an area, see Section 9.8.2, paragraph 31.c.(2) for which coordinates cannot be applied, e.g., Chicago District; or,

(2) If non-geographical data are used, e.g., AIRCRAFT.

c. For a station aboard a Geostationary satellite, insert 000000N.

d. For a station aboard a Non-geostationary satellite or a Deep Space vehicle, leave this field blank.

e. Insert N for North or S for South latitude in the last space as applicable.

f. For assignments where the transmitter and receiver equipment is not collocated then enter the RLA of the receiving antenna; otherwise, enter the same coordinates contained in XLA.

### **34. RLG--Receiver Antenna Longitude (8 Characters--30 Occurrences)**

a. Insert in degrees (3 characters), minutes (2 characters) and seconds (2 characters), the longitude of the site named in the RECEIVER ANTENNA LOCATION (RAL) field. Insert leading zeros for degrees, minutes, and seconds as required. Seconds shall be provided whenever possible; however, if it is impracticable to obtain the exact seconds, insert the closest seconds available. Coordinates will be referenced to the World Geodetic System Code 84/North American Datum 83. If another system code is used the type and reason will be entered in the supplementary remarks section.

b. Leave this field blank if:

(1) the site named in the RECEIVER ANTENNA LOCATION (RAL) field is an area for which coordinates cannot be applied, e.g., Chicago District; or,

(2) if non geographical data are used, e.g., AIRCRAFT.

c. For a station aboard a Geostationary satellite, insert the longitudinal position of the satellite in degrees (3 characters) and minutes (2 characters) East or West longitude. In this case always enter 00 in the seconds portion of this field. Use leading zeros as required.

d. For a station aboard a Non-geostationary satellite, or a Deep Space vehicle, leave this field blank.

e. Insert E for East or W for West longitude in the last space as applicable.

f. For assignments where the transmitter and receiver equipment is not collocated then enter the RLG of the receiving antenna; otherwise, enter the same coordinates contained in XLG.

### **35. RAP--Receiver Antenna Polarization (3 Characters--30 Occurrences)**

a. Receiver antenna polarization is required on applications:

(1) For receiving Earth or Terrestrial stations (including experimental stations) employing Earth station techniques; or

(2) For receiving Space or Terrestrial stations (including experimental stations) using Space station techniques; or

(3) For receiving Terrestrial stations at 420 MHz and above.

b. Receiver Antenna Polarization is not required on applications for:

(1) Experimental stations except as indicated in 26.a.(2) and (3);

(2) Mobile stations;

(3) Portable stations;

(4) Radiolocation mobile stations;

(5) Radionavigation mobile stations;

- (6) Transportable stations;
  - (7) Group assignments;
  - (8) A period of six months or less;
  - (9) Meteorological Aids in the 1660-1700 MHz band;
  - (10) TACAN/DME stations in the 960-1215 MHz band;
  - (11) Aeronautical Telemetry stations in the 1435-1535, 2200-2290, and 2310-2395 MHz bands;
  - (12) Stations using radar;
  - (13) Passive reflectors.
- c. This field may be completed on other applications at the option of the applicant.
- d. If more than one antenna is to be used, insert the polarization of the antenna to be used most frequently; however, for a space station, antenna polarization may be listed for up to three antennas, provided they are entered in the same sequence as the antenna data entered in the RECEIVER ANTENNA DIMENSIONS (RAD) field.
- e. Insert one of the following letters or combination of letters to indicate the antenna(s) polarization:
- A--Elliptic, Left
  - B--Elliptic, Right
  - D--Rotating
  - E--Elliptical
  - F--45 Degrees
  - H--Horizontal
  - J--Linear
  - L--Left Hand Circular
  - M--Oblique Angled, Left
  - N--Oblique Angled, Right
  - O--Oblique Angled, Crossed
  - R--Right Hand Circular
  - S--Horizontal and Vertical
  - T--Right and Left hand Circular
  - V--Vertical
  - X--Other

### **36. RAZ--Receiver Antenna Orientation (3 Characters--30 Occurrences)**

a. TERRESTRIAL STATIONS: On applications for assignments to Terrestrial stations complete this field in accordance with the procedures given below for the applicable frequency range. Enter one of the following as applicable:

(1) For directive antennas oriented in a fixed direction, including off-site passive reflectors listed in the RECEIVER ANTENNA LOCATION (RAL) field, enter a three-digit number indicating the azimuth of the main antenna lobe in degrees east of True North, using leading zeros as necessary and 360 for True North.

(2) For stations using on-site passive reflectors, displaced vertically from the primary antenna or installed on the same antenna farm as the primary antenna (normally within 150 meters of the receiver), enter the horizontal azimuth of the on-site passive reflector.

(3) S--For directive antennas that operate in fixed mode (direction) but are steerable in the horizontal plane, e.g., steerable log periodic.

(4) ND--For non directive antennas.

(5) R--For antennas rotating through a full 360 degree azimuth while in operation.

(6) SSH--For antennas scanning horizontally through a limited sector.

(7) SSV--For vertically scanning (nodding) antennas.

(8) T--For tracking antennas capable of continuous reorientation for the purpose of maintaining optimum observance of a moving station or object.

b. TERRESTRIAL STATIONS BELOW 29890 kHz

(1) On applications for assignments to fixed (FX) stations in the band 3000 to 29890 kHz, enter the appropriate code in accordance with paragraph 36a.(1) (8). This field may be left blank if the ANTENNA LOCATION is an area representing multiple receiving stations, (e.g., Chicago District, or if the application bears either the Note S362 or S189).

(2) On applications for assignments below 29890 kHz, other than those for fixed (FX) stations in the band 3000 to 29890 kHz, this field may be completed at the option of the applicant in accordance with paragraph 36a.(1)-

(8).

c. TERRESTRIAL STATIONS AT 29890 kHz AND ABOVE

(1) On applications for assignments to stations at 29890 kHz and above enter the appropriate code in accordance with 36a.(1)-(8).

(2) This field may be left blank on applications for:

- a) Experimental stations;
- b) Mobile stations;
- c) Portable stations;
- d) Radiolocation mobile stations;
- e) Radionavigation mobile stations;
- f) Transportable stations;
- g) Group assignments;
- h) A period of six months or less;
- i) Marker Beacons in the 74.8-75.2 MHz band;
- j) VOR/ILS in the 108-117.975 MHz band;
- k) Stations in the Aeronautical Mobile service in the 117.975-136 MHz band;
- l) Stations in the aeronautical and maritime mobile services in the 138-144, 148-150.8, 157.0375-157.1875, 225-328.6, 335.4-399.9 MHz bands, or on the frequencies 156.6, 156.7, 161.6 MHz;
- (m) Glideslopes in the 328.6-335.4 MHz band;
- (n) Meteorological aids in the 400.05-406, and 1660-1700 MHz bands;
- (o) TACAN/DME in the 960-1215 MHz band;
- (p) Aeronautical Telemetry stations in the 1435-1535, 2200-2290, and 2310-2395 MHz bands; and
- (q) Stations using radar.

(3) On applications for assignments that are listed above as exceptions, this field may be completed at the option of the applicant.

d. EARTH STATIONS: For Earth and terrestrial stations (including experimental stations) employing Earth station techniques, insert the letter V followed by a two-digit number expressing the minimum operating angle of elevation of the antenna, in degrees, from the horizontal for geostationary satellites and the minimum operating angle of elevation of the antenna, in degrees, from the horizontal for non-geostationary satellites.

e. SPACE STATIONS: For Space and terrestrial stations (including experimental stations) employing space station techniques, enter one of the following, whichever is applicable.

- (1) NB--for narrow beam antennas, (i.e., substantially less than earth coverage); or
- (2) EC--for earth coverage antennas; or
- (3) Leave the field blank in the case of space-to-space operations.

**37. ACL--Receiving Station Call Sign (8 Characters--30 Occurrences)**

a. This field is optional and is for the call sign assigned to the station which will receive transmissions from the station listed in the Transmitter Antenna Location (XAL) field.

b. Insert the full call sign starting in the first position sign left-justified; however, those that do not require eight spaces and that are formed by letters followed by numbers, insert the letters with left-justified and the numbers with right-justified.

**38. RAD--Receiver Antenna Dimensions (24 Characters--30 Occurrences)**

This field shall be completed in accordance with the following procedures. Each entry is dependent upon frequency range and type of station, (i.e., TERRESTRIAL, EARTH or SPACE). Antenna gain must be entered in decibels with reference to an isotropic (dBi) source. Where gain is derived from a source in reference to a dipole (dBd), the dBi gain can be determined by adding 2.15 to the dBd gain ( $\text{dBd} + 2.15 = \text{dBi}$ ) (ref: ITT Reference Data for Radio Engineers). Enter data according to the following:

a. TERRESTRIAL STATIONS BELOW 29890 kHz:

(1) This field may be left blank if the ANTENNA LOCATION (RAL) is an area representing multiple receiving stations, e.g., Chicago District, or if the application bears either of the Notes S362 or S189.

(2) Gain is required on applications for assignments to fixed (FX) stations in the band 3000 to 29890 kHz. Only the gain shall be entered in characters 1-3 of this field. Characters 4-24 shall be blank. The following formatting instructions apply: Insert in characters one and two, an appropriate two digit number which represents the gain; use a leading zero if the gain is less than ten. Insert the letter G in the third character (e.g., 04G, 20G). If the gain is zero

it shall be entered as 00G.

(3) On all other applications for assignments below 29890 kHz, this field may be completed at the option of the applicant. However, if completed it must be in accordance with (2) above.

b. TERRESTRIAL STATIONS at 29890 kHz and ABOVE:

(1) This field may be left blank on applications for:

- (a) Experimental stations;
- (b) Mobile stations;
- (c) Portable stations;
- (d) Radiolocation mobile stations;
- (e) Radionavigation mobile stations;
- (f) Transportable stations;
- (g) Group assignments;
- (h) A period of six months or less;
- (i) Marker Beacons in the 74.8-75.2 MHz band;
- (j) VOR/ILS in the 108-117.975 MHz band;
- (k) Stations in the aeronautical mobile service in the 117.975-136 MHz band;
- (l) Stations in the aeronautical and maritime mobile services in the 138-144, 148-150.8, 157.0375-157.1875, 225-328.6, 335.4-399.9 MHz bands, or on the frequencies 156.6, 156.7, 161.6 MHz;
- (m) Glideslopes in the 328.6-335.4 MHz band;
- (n) Meteorological aids in the 400.05-406, and 1660-1700 MHz bands;
- (o) TACAN/DME in the 960-1215 MHz band;
- (p) Aeronautical telemetering stations in the 1435-1535, 2200-2290, and 2310-2395 MHz bands;
- (q) Stations using radar.

(2) On all applications for assignments above 29890 kHz that are listed in 38.b.(1)(a)-(q) as exceptions, this field may be completed at the option of the applicant.

(3) If more than one antenna is to be used, insert the data for the antenna to be used most frequently.

(4) The following formatting instructions apply:

(a) GAIN--Insert in the first two characters a two-digit number representing the nominal gain of the antenna in decibels. Insert a zero in the first space if the gain is less than ten. Enter the letter G in the third space. If the gain is zero, or antenna is a passive reflector, enter 00G.

(b) NAME--Starting with the fourth character, insert an abbreviation from the list of approved antenna names and the associated authorized abbreviations listed in Annex G, G.6. If the antenna is not listed, forward the new antenna name, abbreviation, and manufacturer specification sheet to the FAS for inclusion into Annex G, G.6 prior to submitting proposals.

(c) ELEVATION--Starting with the 14th character, enter a five-digit number representing the site (terrain) elevation in meters above mean sea level (MSL). Use all five spaces, inserting leading zeros as applicable. For a site below MSL, enter a dash in the 14th space and a four digit number. Insert the letter H in the 19th space. Leave blank for assignments to transportable receiving stations (S362).

(d) HEIGHT--Starting with the 20th character insert a four-digit number representing the antenna height in meters above terrain. Use all four spaces, inserting leading zeros as applicable. Insert the letter T in the 24th space.

*Example:* RAD01 10GCORNREFLTR06550H0175T

c. EARTH STATIONS: The following formatting instructions apply to both Earth and Terrestrial stations (including experimental stations) employing Earth station techniques.

(1) Use the entire 24 characters to record the following particulars:

(a) GAIN--Insert in the first two characters a two-digit number representing the gain of the antenna in the direction of maximum radiation. Insert a zero in the first character if the gain is less than ten. Enter the letter G in character three. For a negative gain, insert XXG and give the value in the CIRCUIT REMARKS \*EGN field.

(b) BEAMWIDTH--Beginning with character four, insert a three-digit number representing the antenna beamwidth (degrees) at the half power points. Use all three spaces, inserting leading zeros as applicable. Enter the letter B in character seven. For a beamwidth requiring more than three spaces, insert XXXB and give the value in the CIRCUIT REMARKS \*EBW field.

(c) AZIMUTH--In characters eight through fourteen, insert the azimuth angles (in degrees clockwise from True North) of the main beam. If the Earth station is to communicate with a single Geostationary satellite,

insert the azimuth angle to the satellite in spaces eight through ten (use leading zeros), a slant bar in space eleven, and XXX in spaces twelve through fourteen. If it is to communicate with two or more geostationary satellites, separate applications are required for each Earth station azimuth. If the Earth station is to communicate with non-geostationary satellites or is mobile or transportable, and is to communicate with a geostationary satellite, indicate the range of azimuth angles over which the Earth station antenna will point by inserting in spaces eight through ten a three-digit number representing one of the extreme azimuth angles, a hyphen in space eleven, and a three-digit number in spaces twelve through fourteen representing the other extreme angle. Use leading zeros as necessary and 360 for True North. In character fifteen insert the letter A.

(d) ELEVATION--Starting with character sixteen, insert a five-digit number representing the site (terrain) elevation in meters above mean sea level (MSL). Use all five spaces, inserting leading zeros as necessary. In character twenty-one insert the letter H.

For mobile or transportable stations, leave blank.

(e) HEIGHT--Starting with character twenty-two, insert a three-digit number representing the antenna height in meters above terrain. Use all three spaces, inserting leading zeros as applicable. For an Earth station aboard an aircraft, insert a two-digit number followed by the letter K to denote the maximum operational altitude of the aircraft in thousands of feet above mean sea level.

For altitudes under 10,000 feet insert a leading zero.

*Example:* RAD01 35G106B010/XXXA05200H025

d. SPACE Stations: The following formatting instructions apply to both Space and Terrestrial stations (including experimental stations) using space station techniques:

(1) This field provides room for the details of up to three antennas per Space station. If the station uses more than three antennas for the requested frequency, provide data for the three most frequently used antennas.

(2) Use characters one through seven for the details of the first antenna. Enter:

(a) GAIN--Insert in the first two characters a two-digit number representing the gain of the antenna in the direction of maximum radiation. Insert a zero in the first character if the gain is less than ten. Enter the letter G in character 3. For a negative gain, insert XXG and give the value in the CIRCUIT REMARKS \*SGN field.

*Examples:* RAD01 20G015B  
RAD01 08G.25B  
RAD01 XXG105B  
RAD01 20GXXXB

(b) BEAMWIDTH--Beginning with character four, insert a three-digit number representing the antenna beamwidth (degrees) at the half power points. Use all three spaces, inserting leading zeros as necessary. Insert the letter B in space seven. For a beamwidth requiring more than three spaces, insert XXXB and give the value in the CIRCUIT REMARKS \*SBW field.

(3) If the assignment involves the use of a second antenna:

(a) Insert a slant bar in character eight; and

(b) Use characters nine through fifteen for the details as specified in paragraph 38.d.(2)(a) and (b).

*Examples:* RAD01 20G016B/10G.30B

(4) If the assignment involves the use of a third antenna:

(a) Insert a slant bar in character sixteen; and

(b) Use characters seventeen through twenty three for the details of the third antenna as specified in paragraph 38.d(2) (a) and (b).

*Example:* RAD01 10G025B/20G.30B/30G1.9B

(5) Leave character twenty-four blank.

### **39. Circuit Remarks (REM) (40 Characters-30 Occurrences)**

The CIRCUIT REMARKS field is used primarily to record frequency assignment characteristics that have no

specific fields provided for them on the application, particularly amplifying data concerning the frequency, antenna location, and equipment characteristics. General rules for the formation of entries are given below followed by specific rules for each type of entry. The use of this field is limited to the following types of entries for which specific rules are given:

*AGN	*CLS	*EST	*NRM
*ARB	*CLU	*FBE	*NTS
*ARR	*DFI	*FLN	*ORB
*ART	*DOC	*FRB	*PRD
*CAN	*EBW	*IFI	*PRR
*CDD	*EGN	*JNT	*RAD
*CDE	*EQR	*LSB	*RPT
*CLA	*EQS	*LSR	*SBW
*CLC	*EQT	*LST	*SGN
*CLF	*ESB	*MEX	*TRN
*CLR	*ESR	*MFI	*USA

#### *a. General Rules*

(1) Entries are always preceded by the mnemonic REM, the occurrence number, an asterisk, and a three letter identifying code followed by a comma, e.g., REM01 \*FRB,. In this field, an asterisk is used only for this purpose. Entries concerning frequency bands precede other entries. Enter these data immediately after the comma at the end of the identifying code. The data may be any combination of words and elements. An element is a code or a numeric value. If the data consist entirely of elements, the number of spaces for each element is specified, and the position of each element with respect to the identifying code is specified. If an element is numeric, fill all spaces using leading zeros as necessary. If an element is a code, left-justified in its allocated space, and, if it requires fewer spaces than are allocated, leave the spaces on the right side blank. To increase readability, a word may be used as a code.

(2) Where necessary, specific rules require an entry be completed within a single 40-character line. This is to prevent the division or breaking of an element between two lines. If the use of more than one entry is permitted and is necessary, the identifying code for that entry is entered again at the beginning of each line which is used. Such entries should not have a hyphenated word at the end of a line.

#### *b. Frequency Band Data (\*FRB)*

On an application for a band of frequencies, e.g., 1200 MHz to 1300 MHz enter the lower limit of the band in the FREQUENCY field and both the lower and upper limits in the CIRCUIT REMARKS field.

(1) Insert the identifying code REM01 \*FRB always as the first entry in the CIRCUIT REMARKS field.

(2) Insert a comma in the 5th space.

(3) Insert the lower limit of the frequency band in the 13 spaces immediately following the comma. Express the frequency in KiloHertz (kHz) below 30000 kHz; in MegaHertz (MHz) from 30 MHz to (but not including) 100,000 MHz; in GigaHertz (GHz) from 100 GHz to (but not including) 3000 GHz; and in TeraHertz (THz) at 3 THz and above. Insert in the first space after the comma the number 0 (zero) if the frequency is expressed in KiloHertz, the letter M if the frequency is expressed in MegaHertz, the letter G if the frequency is expressed in GigaHertz, and the letter T if the frequency is expressed in TeraHertz. Always insert a decimal point in the 7th space from the comma. The numeric value of the frequency must completely fill the 13 allotted spaces, leading zeros to the left of the decimal and ending zeros to the right of the decimal being used as necessary.

(4) Insert a comma in the 19th space immediately after the lower limit of the frequency band.

(5) Starting with the 20th space, insert the upper limit of the frequency band as explained in (3) above.

#### *Examples:*

```
REM01 *FRB,015010.000000,015100.000000
REM01 *FRB,010000.000000,M00050.000000
REM01 *FRB,M00162.012500,M00162.587500
REM01 *FRB,M90000.000000,G00110.000000
```

*c. Excluded Frequency Band Data (\*FBE)*

In the case of an application for a band of frequencies where a portion of the band is to be excluded, the lower and upper limits of the band are inserted as the first entry as stated under Frequency Band Data above. The portion to be excluded is then inserted as the second entry in the CIRCUIT REMARKS field.

(1) Insert the identifying code \*FBE always as the second entry.

(2) Insert a comma in the 5th space.

(3) Insert the lower limit of the excluded portion in the 13 spaces immediately following the comma. Express the frequency in kiloHertz (kHz) below 30000 kHz; in MegaHertz (MHz) from 30 MHz to (but not including) 100,000 MHz; in GigaHertz (GHz) from 100 GHz to (but not including) 3000 GHz; and in TeraHertz (THz) at 3 THz and above. Insert in the first space after the comma the letter M if the frequency is expressed in MegaHertz, the letter G if the frequency is expressed in GigaHertz, and the letter T if the frequency is expressed in TeraHertz. Always insert a decimal point in the 7th space from the comma. The numeric value of the frequency must completely fill the 13 allotted spaces, leading zeros to the left of the decimal and ending zeros to the right of the decimal being used as necessary.

(4) Insert a comma in the 19th space immediately after the lower limit of the excluded portion.

(5) Starting with the 20th space, insert the upper limit of the excluded portion as explained in 3 above.

(6) If additional portions of the frequency band are to be excluded, insert each portion on a succeeding entry in ascending order as explained in (1) through (5) above.

*Examples:*

REM01\*FRB,M00960.000000,M01700.000000

REM02\*FBE,M01400.000000,M01427.000000

REM03\*FBE,M01660.000000,M01670.000000

Under this example the following bands would be authorized:

960-1400 MHz

1427-1660 MHz

1670-1700 MHz

*d. Authorized Area of Operation (\*RAD)*

Enter a radius of operation from a given geographical location for mobile stations, transportable stations, and multiple transmitting and/or receiving stations (NOTE S361). Normally this geographical location is that of a fixed station; if no fixed station is involved, select a center point within the operating cell. A radius is required for:

--Multiple transmitting and/or receiving FIXED stations (NOTE S361) if coordinates are entered in the XLA/XLG and RLA/RLG fields.

--Mobile and transportable stations if coordinates are entered in the XLA/XLG and RLA/RLG fields.

--Multiple transmitting FIXED stations (NOTE S361) if coordinates are entered in the XLA/XLG fields.

--Mobile and transportable transmitter stations if coordinates are entered in the XLA/XLG fields.

--Multiple receiving FIXED stations (NOTE S361) if coordinates are entered in the RLA/RLG fields.

--Mobile and transportable receiver stations if coordinates are entered in the RLA/RLG fields.

(1) Complete the total entry within a single 40-space CIRCUIT REMARKS field, i.e., on one entry.

(2) Insert the identifying code REMnn \*RAD.

(3) Insert a comma after the identifying code.

(4) After the comma insert in the next four spaces the radius in kilometers, using leading zeros as necessary.

(5) For assignments in the AAG frequency bands (see 9.2.1 to identify AAG bands), the radius shall be followed by a comma and its equivalent nautical mile value including the letters NM. If the applicant does not submit the nautical mile equivalent, it will be generated by NTIA.

(6) At the option of the applicant, amplifying data describing the area of operation may be included on the \*RAD entry. Insert a comma after the radius followed by the amplifying data. THE ENTIRE RADIUS ENTRY INCLUDING ALL THE AMPLIFYING DATA SHALL BE CONTAINED WITHIN A SINGLE 40-SPACE CIRCUIT REMARKS LINE.

(7) Should the assignment contain the amplifying data B, R, or T in \*RAD, these indicate:

B - Transmission authorized and reception protected within the radius drawn around the XLA/XLG and RLA/RLG coordinates,

R - Reception protected within the radius drawn around the RLA/RLG coordinates,

T - Transmission authorized within the radius drawn around the XLA/XLG coordinates after the last abbreviation.

Should the assignment contain multiple receiver locations and the area of operation shown applies to some but not all receiver locations, the receiver occurrence number may be shown in the optional data portion of \*RAD. Likewise, if different values for an area of operation pertain to the transmitter and receiver locations, these values are followed by an R or T as indicated above.

*e. Authorized States (\*ESB, \*ESR, \*EST, \*LSB, \*LSR, \*LST)*

The transmitter and receiver ANTENNA LOCATION fields provide an area of operation within four or more states may be described in those fields as US or USA, with the included (\*LSB,\*LSR,\*LST) States being shown in the CIRCUIT REMARKS field. The excluded states field codes (\*ESB,\*ESR,\*EST) can be used on any US, USA or USP assignment and may exclude one or more states as long as four or more states remain. Similarly, USP may be used if the area includes a possession.

(1) Insert one of the following identifying codes after REMnn:

\*LST for transmitting in the states listed.

\*LSR for receiving in all states listed.

\*LSB for transmitting and receiving in the states listed.

\*EST for transmitting in all states except those listed.

\*ESR for receiving in all states except those listed.

\*ESB for transmitting and receiving in all states except those listed.

(2) Insert a comma after the identifying code.

(3) After the comma insert the State or Possession abbreviation as shown in Annex G, Section G.2, followed by another comma.

(4) After the comma insert the abbreviations for the additional states or possessions, separating the abbreviations by commas. Do not insert a comma after the last abbreviation.

(5) If more than one entry is required, repeat the identifying code at the beginning of each entry.

(6) If the fact that operation in any one or more, but not all, of the areas listed under this data entry is classified, separate CIRCUIT REMARKS entries must be made for the classified data and unclassified data in order to comply with the requirements of subparagraphs cc (Classified Data Fields (\*CLD)) and dd (Classified Data Fields (\*CLC or \*CLS)) and dd (Unclassified Data Fields (\*CLU)) of paragraph 39 of this section.

*Examples:*

REM01 \*LST,CA,OR,WA,NV (transmitting in 4 States)

REM03 \*LSR,AL,GA,MS,FL,LA,GA (receiving in 6 States)

REM04 \*LSB,IL,IN,OH,PA (transmitting and receiving in 4 States)

REM02 \*EST,AZ,NM,TX (transmitting in all states except those listed)

*f. Authorized Areas (\*ARB, \*ARR, \*ART)*

The CIRCUIT REMARKS field also may be used to describe areas which cannot be described under Authorized Area of Operation or Authorized States, (e.g. a part of a State or parts of several contiguous states). In such cases the transmitter and/or receiver ANTENNA LOCATION fields would show the name of the state or USA.

(1) Complete the total entry for the Authorized Area within a single 40-space CIRCUIT REMARKS entry, unless the provisions of subparagraph (6) below apply.

(2) Insert one of the following identifying codes after REMnn:

\*ART for transmitting in the area shown.

\*ARR for receiving in the area shown.

\*ARB for transmitting and receiving in the area shown.

(3) Insert a comma after the identifying code.

(4) After the comma insert the data concerning the area. It is preferable to always identify this area as either a square or rectangle, using the four points of the compass in degree and minutes. When this is not possible, use the



abbreviations in Annex G, Section G.2, to identify a state or possession. Use E for east(ern), N for north(ern), S for south(ern) and W for west(ern).

(5) Separate elements by commas.

(6) If the fact that operation in any one or more, but not all, of the areas listed under this data entry is classified, separate CIRCUIT REMARKS entries must be made for the classified data and unclassified data in order to comply with the requirements of subparagraphs cc (Classified Data Fields (\*CLC or \*CLS)) and dd (Unclassified Data Fields (\*CLU)) of paragraph 39 of this section.

*Examples:*

REM01 \*ARB,39N43N098W099W (use leading zero for longitude less than 100 degrees)

REM02 \*ART,3915N4320N10016W10102W

REM03 \*ARR,S OF 33N

REM01 \*ART,S OF 40N,E OF 095W

REM03 \*ART,SW WY,NE UT, NW CO

*g. Docket Numbers of Older Authorizations (\*DOC)*

When renewing or modifying an assignment (see Section 9.9), the docket number applicable to the older authorization is automatically retained in the assignment record. When deleting an assignment and, simultaneously, submitting a NEW or NOTIFICATION action to replace it (see Section 9.7), the docket number applicable to the older authorization is not retained in the assignment records. The absence of the older docket number makes difficult any review of the history of a given authorization. In the latter case, the older docket number may be included in the CIRCUIT REMARKS field of the application immediately following the identifying code \*DOC. In addition, the date of authorization of the older docket and/or the applicable agency serial number may be included, in that order, on the same entry immediately following the docket number.

(1) Complete the total entry within a single 40-space CIRCUIT REMARKS entry.

(2) Insert the identifying code REMnn \*DOC.

(3) Insert a comma after the identifying code.

(4) After the comma insert the docket number(s) of the older authorization(s). Separate multiple docket numbers by commas.

(5) If a date and/or serial number is to be inserted, insert a comma followed by the pertinent data, separating by a comma the date and the agency serial number. Dates must have six digits indicating year, month, and day.

*Examples:*

REM02 \*DOC,84729 (docket only)

REM11 \*DOC,73621,570415 (docket and date)

REM08 \*DOC,67543,551025,N 550142 (docket, date, and serial)

REM03 \*DOC,I8143591,AF 810230 (docket and serial)

REM07 \*DOC,89432,I6723419 (two dockets)

*h. Receiving Repeater (\*RPT)*

This field is used only to identify a receiver location which is used as a repeater in the bands listed in Section 6.1.3, paragraph 2. If the station named in the receiver ANTENNA LOCATION field is used primarily as a repeater, it may be so identified in the CIRCUIT REMARKS field.

(1) Insert the identifying code REMnn \*RPT.

(2) Insert a comma after the identifying code.

(3) After the comma insert the letter R. If there is more than one location entered in the receiver ANTENNA LOCATION field, and if each location is used primarily as a repeater, insert the letter R: however, if some but not all of the locations are used primarily as a repeater, insert the letter R followed by the appropriate receiver.

*Examples:*

REM01 \*RPT,R (Each location entered in the receiver ANTENNA LOCATION field is used primarily as a

repeater.)

REM02, \*RPT,R02 (The location entered as the second receiver ANTENNA LOCATION field is used primarily as a repeater.)

*i. Joint Applications (\*JNT)*

An application that is submitted jointly by two or more agencies is prepared by the agency identified in the AGENCY SERIAL NUMBER field, and all agencies involved are identified in the CIRCUIT REMARKS field, using the agency abbreviation as shown in Annex G, Section G.1.

- (1) Insert the identifying code REMnn \*JNT.
- (2) Insert a comma after the identifying code.
- (3) After the comma insert in the next four spaces the abbreviation of the first agency. Left-justified the abbreviation, leaving blank the spaces to the right if the abbreviation has fewer than 4 characters.
- (4) For the remaining agencies insert the appropriate abbreviations separated by commas.
- (5) If more than one entry is required, repeat the identifying code at the beginning of each entry.
- (6) If the fact that operation in any one or more, but not all, of the areas listed under this data entry is classified, separate CIRCUIT REMARKS entries must be made for the classified data and unclassified data in order to comply with the requirements of subparagraphs cc (Classified Data Fields (\*CLC or \*CLS)) and dd (Unclassified Data Fields (\*CLU)) of paragraph 39 of this section.

*Example:*

REM08 \*JNT,DOE ,AR ,NASA (for this example DOE's serial number would appear in the AGENCY SERIAL NUMBER field).

*j. Agency Data (\*AGN)*

- (1) This CIRCUIT REMARKS field may be used to record agency data that are pertinent to the proposed assignment but not intended to be a part of the authority requested. The data shall not include decodes of the particulars of the proposed assignment.
  - (a) Insert the identifying code REMnn AGN.
  - (b) Insert a comma after the identifying code.
  - (c) After the comma insert the agency data.
  - (d) If more than one entry is required, repeat the identifying code at the beginning of each entry.

*Examples:*

REM02\*AGN,VIA PASSIVE SATELLITE  
REM03 \*AGN,DELETE IN APRIL 1971  
REM04 \*AGN,WIRELESS MICROPHONE  
REM05 \*AGN,SHARED INTERBUREAU  
REM06 \*AGN,NARROWBAND IN FISCAL 1969

- (2) This CIRCUIT REMARKS field will contain the mnemonics FLL, FLT and TSV as applicable to designate operational parameters of station class FA, FAC, FAB, FLU, MA, MAD, MAP, MO, MOE, MOEA, MOEB, and MOU operating in the 118-136.475 MHz and 225-328.6 MHz, 335.4-399.9 MHz bands, Ground Based Transceiver Service (GBTS) using 978 MHz and 1090 MHz would be in the following format:

\*AGN,FLL=XXX,,FLT=XXX,TSV=XXXXX. [REMARKS]  
\*AGN,FLL=050,FLT=230  
\*AGN,FLL=200,FLT=360,TSV=ZDC50

- (a) FLL,FLT entries are documented in hundreds of feet.
  1. 1000 feet      010
  2. 2000 feet      020

3. 10.000 feet      100
4. 35 000 feet      350

(3) When an assignment contains the note S945 the agency must enter the name of the Cubesat or smaller satellite in the Circuit Remarks Field.

*k. Notes (\*NTS)*

The CIRCUIT REMARKS \*NTS field is used to complete the conditional comments of the MINUTE (M--) NOTE agreed to by the FAS. Insert the identifying code REMnn \*NTS, a comma, the MINUTE NOTE, a comma, and the data to complete the MINUTE NOTE.

(1) *Examples:*

<b>Note</b>	<b>Entries</b>
M002	REM02 *NTS,M002,7640924,FCC TO NTIA REM11 *NTS,M002,IRAC, 13381 REM07 *NTS,M002,FAS, 1700927B
M003	REM01 *NTS,M003,WRC/TV, WASHINGTON REM08 *NTS,M003,JOHN SMITH, 415/841/5121 REM03 *NTS,M003,ONR,MINNEAPOLIS
M004	Same as M003
M006	REM02*NTS,M006,ROCKVILLE, MD
M007	REM08 *NTS,M007,NAVY REM09 *NTS,M007,FCC,EIC,NY
M008	REM01 *NTS,M008,FAA,5965kHz, HONO/TOKYO
M009	REM01 *NTS,M009,AF
M010	Same as M009
M011	REM08 *NTS,M011,WABC,NY REM10 *NTS,M011,KHVO/TV, COWLICK,TX
M013	REM11 *NTS,M013,CG SUBJECT TO PRIOR COORD
M014	REM14 *NTS,M014,0010,AGL
M015	REM17 *NTS,M015,IRAC 33221/4,SPS 13928/4
M017	REM09 *NTS,M017,CO,AK
M018	REM07 *NTS,M018,FCC ,070326,JKAM,060717-03

(2) Applies to all frequency bands except 118-136.475 MHz, 225-328.6 MHz, 335.4-399.9 MHz, Ground Based Transceiver Service (GBTS) using 978 MHz and 1090 MHz (See Section 9.2.8.39 j above). Each entry of the station class symbols: AM, AMA, MA, MO, MOE, MOEA, MOEB, or MOU must also contain corresponding information on the maximum aircraft altitude (\*NTS,M014,).

(a) In characters 1 through 4 of the Circuit Remarks Field insert the identifying code \*NTS.

(b) Insert a comma in the 5<sup>th</sup> space.

(c) Insert the M note M014 in spaces 6 thru 9.

(d) Insert a comma in space 10.

(e) Insert the aircraft altitude in 100s of feet in spaces 11 through 14.

1. 1000 feet      0010

2. 2000 feet      0020

3. 10,000 feet    0100

4. 35,000 feet    0350

(f) Insert a comma in the 15<sup>th</sup> space.

(g) Insert AGL if operations are Above Ground Level or MSL if operations are reference Mean Sea Level in spaces 16 through 18.

REMX \*NTS,M014,0010,AGL

(3) M018 Each entry of Pre-coordination Data:

This field is optional and may be used when a frequency application has been pre-coordinated between two agencies prior to the application being submitted to the Frequency Assignment Subcommittee. This field will indicate the agency, date, names and any restrictions/agreements made by the two agencies.

(a) Insert the identifying code REMnn, a space, then \*NTS,M018 followed by a comma.

(b) After the comma, insert the agency abbreviation as specified in Annex G, Section G.1 followed by blank spaces as necessary to complete the four character field with which the applicant agency pre-coordinated.

(c) Insert a comma after the agency's abbreviation.

(d) After the comma, insert the date of the coordination in YYMMDD format.

(e) Insert a comma followed by free text format but should include items such as: the name or initials of the coordinator from the commenting agency, pre-coordination reference, restrictions or agreement text if required.

(f) If additional lines of text are needed, the additional lines shall start with items 1-3 above and contain the continuation of free text.

*Example:* REM02 \*NTS,M018,FCC ,070326,J Kam,060717-03

In the above example, the record was pre-coordinated with the FCC, Mr. Jeff Kam, on March 26, 2007, and the pre-coordination reference is 060717-03.

*1. Canadian Coordination Data (\*CAN)*

(1) An entry is required for all applications which have been coordinated with Canada (see Section 3.4).

(2) After NEW assignments have been coordinated with Canada, the Canadian comments will automatically be entered by NTIA's processing programs in the appropriate REMnn entry as \*CAN, the U.S. coordination serial number, and, either:

(a) NHIA--No Harmful Interference Anticipated; or,

(b) The actual comment received from Canada

*Examples:*

REM08 \*CAN,780029,NHIA

REM02 \*CAN,750361,NO MOBILE USE WITHIN 64 KILOMETERS

REM03 \*CAN,RAD OF BURNABY BC

(3) For updating GMF records, including the use of the record replacement action, the following procedure applies:

(a) If the updated assignment will not increase the probability of harmful interference, agencies are required to retain the existing \*CAN entry, including CAN ORIG; these assignments will not be re-coordinated with Canada.

(b) If the probability of harmful interference is increased, the assignment will be re-coordinated with Canada and the agency should not retain \*CAN data.

(4) If the frequency assignment is to be used in the Canadian coordination border zone defined in Arrangement D, Section 3.4.6, and,

(a) the frequency is 408.400 MHz the Canadian coordination program will automatically enter:

\*CAN,CAN LTR 17 JAN 79. NO OBJ NIB.

\*CAN,CANADA USE EXCL FOR RADIO ASTRONOMY

(b) the frequency is either 418.050, 418.075, or, 418.575 MHz the Canadian coordination program will automatically enter:

\*CAN,CAN LTR 17 JAN 79, AGREE COMM CAN

\*CAN,U.S. USE ON A SHARED NON PRI BASIS

*m. Number of Stations and System Name/Identifier (\*NRM)*

(1) The Circuit Remarks (\*NRM) field is used to indicate the number of stations and system name/identifier with which the assignment may be identified.

(2) A station is one or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service. A system is two or more stations that have a common property, usually geographic, administrative, functional, or operational in nature.

(3) System names/identifiers shall be determined by the applicant and may be alphabetic, numeric, or alphanumeric. Each shall be unique within an agency but may be used by more than one agency. Systems names/identifiers shall not contain more than 29 characters including spaces. If abbreviations are used, the system names/identifier shall be abbreviated the same way each time it is used within a given agency.

(4) The word NET may be used as the system name for each assignment that represents an entire system, e.g., a single base station and a number of mobile stations that communicate on a single frequency.

(5) If the identity of a system is applied to a particular frequency assignment, it is the responsibility of the applicant agency to ensure that the same name/identifier is recorded in the particulars of all assignments associated with that same system.

(6) The entry (\*NRM), including the number of stations and system name/identifier is required if:

(a) the assignment is within one or more of the following frequency ranges:

30.0-50.0 MHz \*  
138.0-144.0 MHz  
148.0-149.9 MHz  
150.05-150.8 MHz  
162.0-174.0 MHz  
406.1-420 MHz

\* Limited to bands allocated exclusively to the Federal Government.

and

(b) the frequency assignment has one or more of the following station class symbols:

FB	FL	FLEC	MLP	MOEB	MS
FBD	FLD	FLH	MO	MOEC	MSD
FC	FLE	FLU	MOD	MOH	MSP
FCB	FLEA	ML	MOE	MOP	
FCD	FLEB	MLD	MOEA	MOU	

or

(c) the assignment is within one or more of the frequency ranges listed in (6)(a) and the letter “R” is appended to any of the station classes listed in (6)(b); or

(d) the assignment is within one or more of the frequency ranges in (6)(a) and the NOTES (NTS) field contains either S361 or S362. or,

(e) the assignment is for a frequency above 29890 kHz and the transmitter STATE/COUNTRY (XSC) field contains US, USA, or USP; except, where the NOTES (NTS) field contains S322.

(7) Except as provided in (6) above, the entry may be used to record only the system name/identifier of the system with which the assignment is associated (see (10)(e) below).

(8) At the option of the applicant \*NRM data may be recorded for all other assignments or,

(9) The figure recorded for the number of stations shall represent either the exact number or a range of numbers determined as follows:

Within the range	Record the number
1-10	10
11-30	30
31-100	100
101-300	300
Above 300	Nearest 100

The number recorded shall be the same on each application for an assignment associated with the particular system. If the figure changes, all associated assignments shall be amended.

(10) The following detailed instructions shall be used to record \*NRM data:

- (a) Complete the total entry within a single line.
- (b) Insert the identifying code REMnn \*NRM.
- (c) Insert a comma in column 5.
- (d) Beginning in column 6 insert a five digit number to indicate the number of stations. Use leading zeroes as necessary; or
- (e) Beginning in column 6 insert in the next five spaces the letters XXXXX if data are being provided in accordance with (7) above.
- (f) Insert a comma in column 11.
- (g) Insert the system name/identifier beginning in column 12 (a maximum of 29 columns are available for this data).

*Examples:*

```
REM03 *NRM,00100,MIAMI (31 to 100 stations for the MIAMI system)
REM05 *NRM,00045,REGION2 (45 stations for the REGION 2 system)
REM01 *NRM,00010,HHS1 NET (1 to 10 stations for a single assignment that represents an entire system)
REM04 *NRM,XXXXXX,BD046
REM02 *NRM,XXXXXX,ELLSWRTHD SATAF
REM01 *NRM,XXXXXX,NOPRAIRI 2
REM09 *NRM,XXXXXX,SOUTH JACKSONVILLE
```

(11) Agencies desiring to distinguish between the number of mobiles and portables in use for their assignments may do so in the following manner:

```
REM02 *NRM,00100,M,REGION3
REM03 *NRM,00275,P,REGION3
```

Indicating separate numbers for mobiles and portables is optional. If only one number is shown that number indicates the sum of both mobiles, portables and stations. The option exists even when an agency desires to indicate a portable station class in STC. Similarly, if an agency DID NOT desire to use a portable station class in STC that agency could indicate an \*NRM line for the mobile stations and a separate \*NRM line for the portable stations.

*n. Pulse Repetition Rate (\*PRR)*

(1) On an application for assignment to a station using a secondary radar on the frequency 1030 MHz or for pulsed radars operating in the bands 1215-1390, 2700-2900, and 9000-9200 MHz, enter the pulse repetition rate in \*PRR.

(2) Insert the field code REMnn followed by one space, the code \*PRR, then a comma. After the comma insert the numeric value, preferably a measured value, for the specific pulse repetition rate to be used. PRR will be indicated in pulses per second up to and including 999 PPS and in thousands at 1000 PPS and above, adding the letter K at the end of the numeric value for the latter. For equipment having a capability for more than one specific PRR, insert the appropriate numerical values separated by a slant bar. For equipment having a capability for continuously variable PRRs over a wide range, insert upper and lower numerical values separated by a dash. At the option of the applicant, \*PRR may be included on applications for pulsed equipment operating in any band.

*o. Equipment Characteristics (\*EQR, \*EQS, \*EQT)*

(1) All applications for new stations above 29.89 MHz, except as indicated in paragraphs (2) and (3) below, shall contain the indicated data on equipment nomenclature and, where applicable, the data shall be entered as specified in paragraph (4) below. At the option of the applicant, data on nomenclature may be included on applications below 29.89 MHz.

(2) Equipment nomenclature is not required, neither EQT/EQR nor EQS, in the following cases, but may be included at the option of the applicant:

(a) On application with S321 or S322 in the Notes field.

(b) For XR class of station used for terrestrial radiocommunication. XR class of station used for space radiocommunication requires EQT and EQR.

(c) For MO, ML, MA, or MS classes of station, including whenever suffixed by one or two letters, e.g., MOE, MOEA.

(d) For Doppler radars (speed meters or speed guns) on frequencies 10525 MHz, 24150 MHz, or 35.5 GHz, which are FCC type accepted.

(3) Receiver nomenclature (EQR) is not required for:

(a) BC, BCI, BT, EE, or SS classes of station;

(b) ECM or ECCM operations;

(c) TACAN/DME;

(d) Markers in the band 74.8-75.2 MHz; or signal generators; however, transmitter nomenclature (EQT) is required;

(e) 1030 MHz.

(4) The following special provisions apply in the case of certain types of applications:

(a) The nomenclature data entered on applications for group assignments (see Section 9.6.5) may be representative of the equipment concerned.

(b) For pulsed radars in the bands 1215-1390, 2700-2900, and 9000-9200 MHz, the tune-ability and pulse duration capability of the transmitter shall be entered on the EQT line after the transmitter nomenclature, except when the provisions of subparagraph (5) below apply. The pulse repetition rate shall be entered in \*PRR.

(c) In the case of certain applications in the bands 29.89-50.00, 108.000-117.975, 150.8-174.0, 328.6-335.4, 406.1-420.0 and 450-512 MHz, a code may be entered instead of nomenclature to indicate the technical characteristics of typical equipment.

(5) If any of the data, but not all, to be entered in an equipment characteristics data field entry are classified, separate CIRCUIT REMARKS entries must be made for the classified data and unclassified data in order to comply with the requirements of subparagraphs cc (Classified Data Fields (\*CLC or \*CLS)) and dd (Unclassified Data Fields (\*CLU)) of paragraph 39 of this section. (An example of such mixed data that would require separate entries is when the equipment nomenclature of a radar system is unclassified, yet the pulse duration or tunability is classified.)

*Example:*

REM04 \*EQT,G,//AN/RADAR-12\$AT-1221

REM05 \*EQT,G,TC,PD2M/6M

REM08 \*CLC,REM05,ETC,ETC,ETC

REM09 \*CLU,ALL DATA NOT LISTED IN \*CLC OR \*CLS

## **General**

1. The nomenclature for the transmitters and receivers associated with the assignment shall be indicated. If the nomenclature includes prefixes or suffixes such as MOD or MOD and a numeral, include these symbols. If the nomenclature includes the word "MARK", use the abbreviation MK. In lieu of transmitter or receiver nomenclature, the system nomenclature may be indicated. (System nomenclature is defined, for purposes of this section, as that nomenclature assigned to a combination of equipment, e.g., AN/GRC-27 consisting of a T217 transmitter, an R278 receiver, and an AT197 antenna.)

2. Antenna nomenclature may be provided at the option of the applicant.

3. If both a federal nomenclature and a commercial model number are associated with the same equipment, the

federal nomenclature is preferred.

4. If only a commercial model number is available, also indicate the manufacturer of the equipment. A list of manufacturer names and associated codes is printed in Section G.5. If the manufacturer's name is not listed, email the FAS Secretary with the new manufacturer's name and a suggested code. The FAS Secretary will reply to your request with the approved three letter manufacturer code that will be entered in Section G.5.

5. If neither a federal nomenclature nor a commercial model number has been assigned, the manufacturer's code and a short descriptive name of the equipment shall be entered in the CIRCUIT REMARKS field.

6. For commercial radars the Manufacturer Code is required to be entered for the first occurrence of \*EQT and \*EQR only.

7. Entries may be continued on additional Circuit Remarks lines, if necessary.

### **Transmitters**

For transmitters insert the following:

#### **Identifying Code**

Insert the Identifying Code REMnn \*EQT.

#### **Commercial/Federal Government Equipment Code**

Insert a comma after the Identifying Code followed by G for a Federal Government nomenclature, C for a commercial model number, or U if neither has been assigned.

#### **Nomenclature (Transmitters)**

Insert a comma after the Commercial/Federal Government Equipment Code followed by the nomenclature of the transmitter. If a commercial model number is used, enter the manufacturer's code before the model number. If more than one type of transmitter is used, separate the nomenclature/model numbers by commas. In lieu of the transmitter nomenclature, the system nomenclature may be provided by inserting two slant bars (//) followed by the system nomenclature. If neither a Federal Government nomenclature nor a commercial model number has been assigned enter \*EQT,U, the abbreviation of the manufacturer's code, a short descriptive name of the transmitter, and disregard the instructions for antenna nomenclature in the following paragraph.

#### **Nomenclature (Antenna)**

If the transmitter is associated with a specific antenna nomenclature, it may be included, at the option of the applicant, by inserting the symbol \$ followed by the antenna nomenclature.

*Examples: (Transmitters)*

REM02 \*EQT,G,T128MOD2

A Federal Government nomenclature transmitter whose nomenclature is T128MOD2; this is a modification of the original T128 transmitter.

REM04 \*EQT,C,MOTB93MPB

A commercial transmitter manufactured by Motorola, with model number B93MPB.

REM04 \*EQT,G,//AN/ARC322\$AS102

A Federal Government nomenclatured system AN/ARC322 which utilizes an AS102 antenna.

#### **Pulsed Radars in the Bands 1215-1390, 2700-2900, and 9000-9200 MHz**

Immediately after the transmitter nomenclature, insert the tunability and pulse duration capability of the radar transmitter, as described below. Enter the pulse repetition rate capability in \*PRR. At the option of the applicant, these data may be included on applications for pulsed radars in other bands.

#### **Tunability**



After the transmitter nomenclature, insert a comma and one of the tunability codes FA, FX, FV, TC, or TS, according to the following:

FA For frequency agility radars which operate on various frequencies within a band, either in a specified or random mode.

FX For radars capable of operating only on a single discrete frequency.

FV For radars that operate on a discrete frequency determined by the characteristics of a fixed magnetron or similar radio frequency generating device.

TC For radars capable of being tuned to any frequency within the authorized band.

TS For radars capable of being tuned across the authorized band in discrete steps or increments.

### **Pulse Duration**

After the tunability code, insert a comma and the letters PD followed by a numeric value indicating the characteristic pulse duration(s) of the equipment (at the half-power points). PD will be indicated in microseconds up to and including 999 microseconds and in milliseconds at one millisecond and above, adding the letter M at the end of the numeric value for the latter. Fractions may be shown to the nearest tenth by using a decimal. For equipment having a capability for more than one specific PD, insert the appropriate numerical values separated by a slant bar. For equipment having a capability for continuously variable PD's over a wide-range, insert upper and lower numerical values separated by a dash.

*Examples:*

PD1/3/5.6

PD2M/6M

PD1-25

*Example:* REM04 \*EQT,G, //ASR-4,TC,PD0.833

## **Receivers**

For receivers insert the following:

### **Identifying Code**

Insert the Identifying Code \*EQR.

### **Commercial/Federal Government Equipment Code**

Insert a comma after the Identifying Code followed by G for a Federal Government nomenclature, C for a commercial model number, or U if neither has been assigned.

### **Nomenclature (Receivers)**

Insert a comma after the Commercial/Federal Government Equipment Code followed by the nomenclature of the receiver. If a commercial model number is used, enter the manufacturer's code before the model number. If more than one type of receiver is used, separate the nomenclature/model numbers by commas. In lieu of the receiver nomenclature, the system nomenclature may be provided by inserting two slant bars (//) followed by the system nomenclature. If neither a Federal Government nomenclature nor a commercial model number has been assigned, enter \*EQR,U the abbreviation of the manufacturer's code, a short descriptive name of the receiver, and disregard the instructions for antenna nomenclature in the following paragraph.

### **Nomenclature (Antenna)**

If the receiver is associated with a specific antenna nomenclature, it may be included, at the option of the applicant, by inserting the symbol \$ followed by the antenna nomenclature.

### **Occurrence Label Indicator**

If the indicated receiver is used at all receiving locations on the application, no occurrence label needs to be indicated. If the receiver nomenclature is associated with only some of the receiver locations, insert after the nomenclature a plus sign (+) followed by the associated receiver location. Separate the entries for other receiver locations by commas and begin each with the equipment code (G, C, or U).

*Examples: (Receivers)*

REM03 \*EQR,G,RR201

A Federal Government nomenclatured receiver whose nomenclature is RR201 associated with all receiver locations on the application.

REM04 \*EQR,C,RCACR 1004

RCA receiver model CR 1004 associated with all receiver locations on the application.

REM06 \*EQR,G,AN/GRC20\$AS202

A Federal Government nomenclature system—the AN/GRC20 system, using an AS202 antenna associated with all receiver locations on the application.

### **Transceivers**

If a transceiver is used, and the transmitter and receiver do not have separate nomenclatures, the transceiver nomenclature shall be indicated under both \*EQT and \*EQR Identifying Codes.

*Examples:* (Transceivers)

REM04 \*EQT,G,SCR1055

Transmitter entry for Federal Government nomenclature transceiver SCR1055.

REM05 \*EQR,G,SCR1055

Receiver entry for Federal Government nomenclatured transceiver SCR1055.

If a transceiver and its antenna are included as part of the transceiver nomenclature, so indicate by entering the transceiver nomenclature followed by the symbol \$ and the transceiver nomenclature.

*Examples:* (Transceivers/Antennas)

REM02 \*EQT,G,SCR1055\$SCR1055

Transmitter entry for Federal Government nomenclatured transceiver SCR1055 which includes an antenna within the nomenclature.

REM04 \*EQR,G,SCR1055\$SCR1055

Receiver entry for Federal Government nomenclatured transceiver SCR1055 which includes an antenna within the nomenclature.

### **Transmitter Antenna and Receiver Antenna**

In certain instances a single nomenclature/model number has been assigned to combinations consisting of a transmitter and its associated antenna or a receiver and its associated antenna, (i.e., the antenna does not have a nomenclature, but is considered to be part of the transmitter or receiver). In such cases, enter the nomenclature as a transmitter or receiver nomenclature followed by the symbol \$ and the transmitter or receiver nomenclature.

*Examples:*

REM04 \*EQT,G,AN/PRC201\$AN/PRC201

A Federal Government nomenclatured transmitter AN/PRC201 which includes an antenna within the nomenclature.

REM02 \*EQR,G,AN/PRR302\$AN/PRR302

A Federal Government nomenclatured receiver AN/PRR302 which includes an antenna within the nomenclature.

### **Option for Indicating Certain Equipment in the Bands 29.89-50, 150.8-174, 406.1-420, and 450-512 MHz**

If the equipment to be used in these bands has the characteristics of typical single channel, fixed and land mobile, FM equipment with bandwidths not exceeding 16 kHz as outlined in Section 5.3.5, the code LMS may be used instead of equipment nomenclature. When this optional procedure is used, insert the Identifying Code REMnn \*EQS followed by a comma and the code LMS.

*Example:* REM02 \*EQS,LMS

Transmitters and receivers associated with this assignment have characteristics as specified in Section 5.3.5.

Although the equipment characteristics are not outlined in Section 5.3.5, \*EQS,LMS may be used in the 450-512 MHz band.

### **Option for Indicating Certain Equipment in the Bands 108-117.975, and 328.6-335.4 MHz**

If the equipment to be used in these bands has the characteristics and is for the purpose specified in 2 below, the codes indicated in 1 below may be used instead of equipment nomenclature. When this optional procedure is used, insert the Identifying Code \*EQS followed by a comma and the appropriate code from paragraph 1 below.

#### **1. Typical VOR and ILS Equipment Codes**

VOR1A	Standard VHF Omni-Range (100kHz channeling)
VOR1B	Doppler VHF Omni-Range (100kHz channeling)
VOR2A	Standard VHF Omni-Range (50kHz channeling)
VOR2B	Doppler VHF Omni-Range (50kHz channeling)
ILSLOC	ILS Localizer (50kHz channeling)
ILSGS	ILS Glide Slope (150kHz channeling)

*Examples:* (Typical VOR and ILS Equipment)

\*EQS,VOR1A

Standard VOR with 100 kHz channelization having characteristics specified in 2 below.

\*EQS,VOR1B

Doppler VOR with 100 kHz channelization having characteristics specified in 2 below.

\*EQS,VOR2A

Standard VOR with 50 kHz channelization having characteristics specified in 2 below.

\*EQS,VOR2B

Doppler VOR with 50 kHz channelization having characteristics specified in 2 below.

\*EQS,ILSLOC

ILS Localizer having characteristics specified in 2 below.

\*EQS,ILSGS

ILS Glide Slope having characteristics specified in 2 below.

## 2. Typical Equipment Characteristics

### **VHF OMNI-RANGE--100 kHz Channel (Standard--VOR1A, Doppler--VOR1B)**

- |                           |                                                                          |     |     |
|---------------------------|--------------------------------------------------------------------------|-----|-----|
| 1. Lower Frequency:       | 108.0 MHz; Upper Frequency: 117.95 MHz                                   |     |     |
| 2. Frequency Tolerance:   | .002%                                                                    |     |     |
| 3. Emission:              | 21KA9W (with voice) 21KA2A (without voice)                               |     |     |
| 4. Power:                 | 13 to 200 watts                                                          |     |     |
| 5. Modulator Bandwidth:   | 10 kHz                                                                   |     |     |
| 6. Modulator Data:        | 30 Hz - 30%; 9960 Hz -30%; 1020 Hz - 8%; Voice - 28%                     |     |     |
| 7. Emission Falloff:      |                                                                          |     |     |
|                           | $\Delta F$ kHz                                                           | 20  | 60  |
|                           | Level (dB)                                                               | -20 | -60 |
| 8. Spurious Attenuation:  | -80 dB                                                                   |     |     |
| 9. Antenna Type:          | Alford Loop Array (Standard VOR) 50 element antenna array (Doppler VOR). |     |     |
| 10. Horizontal Beamwidth: | 360°                                                                     |     |     |
| 11. Vertical Beamwidth:   | 85°                                                                      |     |     |
| 12. Polarization:         | Horizontal                                                               |     |     |
| 13. Orientation:          | Non-directive                                                            |     |     |

### **VHF OMNI-RANGE (50 kHz Channel) (Standard--VOR2A, Doppler VOR2B)**

- |                           |                                                                           |     |     |     |
|---------------------------|---------------------------------------------------------------------------|-----|-----|-----|
| 1. Lower Frequency:       | 108.0 MHz; Upper Frequency: 117.95 MHz.                                   |     |     |     |
| 2. Frequency:             | Tolerance: 002%                                                           |     |     |     |
| 3. Emission:              | 21KA9W (with voice)<br>21KA2A (without voice)                             |     |     |     |
| 4. Power:                 | 13 to 200 watts                                                           |     |     |     |
| 5. Modulator Bandwidth:   | 10kHz.                                                                    |     |     |     |
| 6. Modulator Data:        | 30 Hz - 30%; 9960 Hz - 30%; 1020 Hz - 8%; Voice - 28%                     |     |     |     |
| 7. Emission Falloff:      |                                                                           |     |     |     |
|                           | $\Delta F$ kHz                                                            | 20  | 30  | 40  |
|                           | Level (dB)                                                                | -30 | -50 | -60 |
| 8. Spurious Attenuation:  | -80dB                                                                     |     |     |     |
| 9. Antenna Type:          | Alford Loop Array (Standard VOR); 50 element antenna array (Doppler VOR). |     |     |     |
| 10. Horizontal Beamwidth: | 360°                                                                      |     |     |     |
| 11. Vertical Beamwidth:   | 80°                                                                       |     |     |     |
| 12. Polarization:         | Horizontal                                                                |     |     |     |

## ILS LOCALIZER (ILSLOC)

1. Lower Frequency: 108.1 MHz; Upper Frequency: 111.95 MHz
2. Frequency Tolerance: 0.002%
3. Emission: 2K04A1A to 15KA9W
4. Power: 5 to 200 watts.
5. Modulator Bandwidth: 3 kHz.
6. Modulator Data: 90 Hz - 20%; 150 Hz - 20%; Voice - 50%; 1020 Hz - 5%.
7. Spurious Attenuation: -75dB
8. Antenna Types: Standard 8-Loop (Alford); V-Ring, Waveguide; Traveling Wave (Alford); Dipole Array (MRN-7); SDF (Simplified Directional Facility).
9. Horizontal Beamwidth: 10° to 360°
10. Vertical Beamwidth: 40°
11. Polarization: Horizontal
12. Orientation: Fixed
13. Channelization: 50 kHz

## ILS GLIDE SLOPE (ILSGS)

1. Lower Frequency: 329 MHz; Upper Frequency: 335 MHz
2. Frequency Tolerance: 0.002%
3. Emission: 300HA1N to 3K3A1N.
4. Power: 1 to 25 watts
5. Modulation Bandwidth: 150 Hz.
6. Modulation Data: 90 Hz - 50%; 150 Hz - 40%
7. Spurious Attenuation: -68dB
8. Antenna Types: Dipoles; Box Antenna; Wave Guide; Cavity
9. Horizontal Beamwidth: 24° to 72°
10. Vertical Beamwidth: 128°
11. Polarization: Horizontal
12. Orientation: Fixed
13. Channelization: 150 kHz

### *p. Point of Contact (\*POC)*

This field is required on all federal radio spectrum applications for use in US&P. This entry identifies the person and associated contact information that validated the assignment data is correct. The field is completed by entering the following data:

- a. Enter the field code REMnn followed by a space. Following the space enter the code \*POC followed by a comma.
- b. Immediately after the comma, enter the name of the individual (not to exceed 17 characters) at the lowest level as designated by the agency followed by a comma.
- c. Immediately after the comma, enter the phone number of the person above using 10 characters followed by a comma.
- d. Immediately after the comma, enter the date when the data on the assignment was validated in six characters in the year, month, and day, and format.

*Example:* REM05 \*POC,JOHN SMITH,7037801234,110627

## Space Radiocommunication Assignments

If the application is for an assignment to earth or space stations or to terrestrial stations (including experimental stations) employing earth or space station techniques, insert the following data in the format indicated:

### *q. Orbital Information on Non-Geostationary Satellites (Transmitting and Receiving) (\*ORB)*

For applications involving a single non-geostationary satellite or multiple non-geostationary satellites having similar orbital characteristics:

- a. Enter the identifying Code REMnn \*ORB followed by a comma.
- b. In the next four spaces, enter the equatorial inclination angle in degrees, using leading zeros as necessary and a decimal with fractional degrees. In the next two spaces, enter the letters IN.
- c. In the next five spaces, enter the apogee in kilometers, using leading zeros as necessary. In the next two spaces, enter the letters AP.
- d. In the next five spaces, enter the perigee in kilometers, using leading zeros as necessary. In the next two spaces, enter the letters PE.
- e. In the next six spaces enter the period, using leading zeros as necessary and a decimal for a fractional unit. If the period is less than 24 hours, enter the period in hours followed, in the next space, by the letter H. If the period is 24 hours or more, enter the period in days followed in the next space, by the letter D.
- f. In the next two spaces, enter the number of satellites in the system, using a leading zero as necessary. In the next two spaces, enter the letters NR.
- g. In the next three spaces, enter T01 for a non-geostationary transmitting satellite and R01, R02, etc. for each non-geostationary receiving satellite if the orbital information is for space-to-space transmissions. Entry is optional for other than space-to-space transmissions.

*Example:* \*ORB,68.8IN40765AP00465PE12.283H01NR

One satellite in the system having orbital characteristics as follows: 68.8 inclination, 40,765 kilometer apogee, 465 kilometer perigee, 12.283-hour period.

For applications with multiple receiving space stations, indicate the orbital information for the satellite of each receiving space station in the Circuit Remarks, followed by the receiver involved (R01, R02, etc.).

*Examples:*

REM01 \*ORB,68.2IN06900AP00239PE022.05H02NRR01  
REM02 \*ORB,72.9IN03209AP00655PE013.46H01NRR02

The orbital characteristics of the two satellites having similar characteristics specified in RAL field R01 are as follows: 68.2 inclination, 6,900 kilometer apogee, 239 kilometer perigee, 22.05-hour period. The orbital characteristics of the one satellite specified in the RAL field R02 are as follows: 72.9 inclination, 3,209 kilometer apogee, 655 kilometer perigee, 13.46-hour period.

h. If any, but not all, of the orbital data are classified, separate CIRCUIT REMARKS entries must be made for the classified and unclassified data in order to comply with the requirements of subparagraphs cc (Classified Data Fields (\*CLC or \*CLS)) and dd (Unclassified Data Fields (\*CLU)) of paragraph 39 of this section. If the data for a non-geostationary transmitting satellite are included in separate entries because of classification, enter T01 in the last three characters of each entry. If the data for non-geostationary receiving satellites are included in separate entries because of classification, enter the appropriate receiving satellite designator R01, R02, etc., in the last three characters of each entry.

*r. Reserved*

*s. Reserved*

*t. Antenna Gain and Beamwidth Requiring Additional Spaces (Earth and Space Stations) (\*EGN, \*SGN, \*EBW, \*SBW)*

(1) The antenna gain for transmitting and receiving earth and space stations is entered in the transmitter and receiver ANTENNA DIMENSIONS fields. Two spaces are available for the value and one space for the letter G. If more than two spaces are required for value, XXG is entered in the ANTENNA DIMENSIONS field and the value is entered in the CIRCUIT REMARKS field following \*EGN (for earth stations) or \*SGN (for space stations). Enter

“T” after the gain to identify the transmitter, or “R” to identify the receiver; for example, \*EGN,1.5T or \*SGN,-05R. For applications with multiple receiving stations with different gain values, the entry in the CIRCUIT REMARKS field is followed by R01, R02, etc., to identify the receiving station involved.

(2) Similarly, the antenna beamwidth for transmitting and receiving earth and space stations is entered in the transmitter and receiver ANTENNA DIMENSIONS fields. Three spaces are available for the value and one space for the letter B. If more than three spaces are required for the value, XXXB is entered in the ANTENNA DIMENSIONS field and the value is entered in the CIRCUIT REMARKS field following \*EBW (earth) or \*SBW (space). Enter “T” after the beamwidth to identify the transmitter, or “R” to identify the receiver; for example, \*EBW, 1.25T or \*SBW, 1.45R. For applications with multiple receiving stations with different beamwidths, the entry in the CIRCUIT REMARKS field is followed by R01, R02, etc. to identify the receiving station involved.

*u. Frequency Authorization Function (\*MFI, \*IFI, \*DFI)*

(1) The Frequency Authorization Function entry indicates the functional use or purpose of a frequency authorization. This entry shall not restrict the applicant from using the frequency for other purposes as circumstances warrant, nor shall the applicant be required to obtain FAS approval before changing the functional use of an assignment. However, the user shall be expected to correct the functional use entry, if appropriate, whenever the assignment is modified or updated.

(2) A Frequency Authorization Function entry is required if:

(a) The frequency assignment falls within one of the following bands:

29.89 - 50.00 MHz\*

162.0125 - 174.0 MHz

406.1 - 420.0 MHz

935.0 - 940.0 MHz\*

\* Limited to bands allocated exclusively to the Federal Government.

and,

(b) The assignment does not bear Record Notes S141 nor S322.

(3) The entry of a Frequency Authorization Function is optional for all other assignments.

(4) The Frequency Authorization Function entry is defined in three fields:

(a) Major Function Identifier (\*MFI) - describes the primary/major function or purpose for which the frequency authorization will be used.

(b) Intermediate Function Identifier (\*IFI) - describes the most significant sub-function or purpose for which the frequency authorization will be used.

(c) Detailed Function Identifier (\*DFI) - describes in greater detail the function(s) or purpose for which the frequency authorization will be used.

(5) All assignments having a Frequency Authorization Function entry shall have an entry for a Major Function Identifier (\*MFI). Entries for Intermediate Function Identifier (\*IFI) and Detailed Function Identifier (\*DFI) are optional. The Function Identifiers with Description lists in Parts 1 and 2, below, contain general and agency specific standard entries for use in any of the three fields.

(6) The Frequency Authorization Function entry is comprised of:

(a) The identifying code \*MFI followed by a comma,

(b) A function identifier selected from the lists in Parts 1 and 2, below,

(c) And, if needed, the identifying code \*IFI followed by a comma and the function identifier selected from the lists in Parts 1 and 2, below,

(d) And, if needed, the identifying code \*DFI followed by a comma and the function identifier selected from the lists in Parts 1 and 2, below, or a description as noted in subparagraph (8)(h), below.

(7) The entries should be entered in the following order if more than one identifier is used: \*MFI; \*IFI; \*DFI. See subparagraphs (8)(h), (i) and (j), below, for other specific instructions.

(8) General rules:

(a) Only one occurrence of \*MFI and \*IFI is allowed. Multiple occurrences of \*DFI are allowed.

(b) Only standard functional identifiers (the name or abbreviation shown in bold in Parts 1 and 2, below) will be used in Frequency Authorization Function entries, except for entries in \*DFI as noted in subparagraph (8)(i) and (j), below. The descriptions included inside the parenthesis in the lists in Parts 1 and 2, below, are shown only for information purposes to assist spectrum managers in selecting the correct data entry.

(c) A specific functional identifier may be entered only once in an application.

(d) Any of the General Function Identifiers listed in Part 1, below, may be used in any of the three function

identifier fields, and there are no association restrictions.

(e) If the frequency authorization will be used for more than one function/purpose, select the functional identifier for the most important function/purpose for entry in the Major Function Identifier (\*MFI). Select the second most important functional identifier for entry in the Intermediate Function Identifier (\*IFI). Enter any additional functional identifier in the Detailed Function Identifier (\*DFI).

(f) If two or more functions are equally important, choose the functional identifier for the function which will make most use of the assigned frequency for entry in the Major Function Identifier (\*MFI). The second functional identifier may be entered in the Intermediate Function Identifier (\*IFI). Additional amplifying information may then be entered in the Detailed Function Identifier (\*DFI) to show other function(s) supported by the assignment.

*Examples:*

REM03 \*MFI,FIRE (A single general function identifier entry)  
REM11 \*MFI,CONSTRUCTION (Two general function identifiers)  
REM12 \*IFI,MAINTENANCE  
REM05 \*MFI,GROUND OPERATIONS (An example with a new DFI)  
REM06 \*IFI,TRAINING  
REM07 \*DFI,NTC EVALUATION EXERCISES  
REM03 \*MFI,SUSTAINING BASE OPERATIONS (An example with multiple DFI's (with agency specific and general identifiers)  
REM04 \*IFI,MAINTENANCE  
REM05 \*DFI,EQUIPMENT CHECKS  
REM06 \*DFI,TEST AND CALIBRATION

(g) General and agency specific functional identifiers may be used in the same application.

(h) If none of the function names in the lists in Part 1 or Part 2, below, accurately reflect the function/purpose of a specific frequency application, enter MISC (Miscellaneous) as the Major Function Identifier (\*MFI), then enter an amplifying description of the function of the assignment in the Detailed Function Identifier (\*DFI). (See subparagraph (9), below.)

*Example:*

REM08 \*MFI,MISC  
REM09 \*DFI,BALLOON RECOVERY OPERATIONS  
REM10 \*DFI,COMMAND AND CONTROL

(i) If SPECIAL PROJECTS is used in \*MFI or \*IFI, \*DFI must contain an amplifying description of the project.

(j) If OTHER OPERATIONS is used, it must be entered in \*MFI and amplifying description of the operation must be entered in the \*IFI or \*DFI.

(9) If MISC is used in \*MFI, and \*DFI contains an amplifying description, or if a new standard Major, Intermediate or Detailed Functional Identifier is proposed, the FAS Representative should submit to the FAS Secretary a request to add a new function name to either of the lists in Part 1 or Part 2, below. The request should contain the proposed function name and a brief description of the function.

### **Part 1 - General Function Identifiers with Description**

The following list contains general function identifiers that have been approved for use by any agency in Major Function Identifier (\*MFI), Intermediate Function Identifier (\*IFI), and Detailed Function Identifier (\*DFI).

**ADMINISTRATIVE**--Used for administrative management of personnel and/or material.

**AIR TRAFFIC CONTROL**--Used for ground-air and air-ground voice communications dedicated to controlling the movement of aircraft.

**BACKBONE**--Used for multiple-function point-to-point communications where landline systems are not available.



**COMMANDER**--Used by commanders at other than top executive echelons to directly command and control operations.

**CONSTRUCTION**--Used to support construction activities (e.g. road building, erection of power lines, construction of dams or bridges, etc.).

**CONTINGENCY**--Used only during unusual situations (e.g. civil disturbances, communications outages, natural disasters, etc.), and kept in service only for the duration of the situation.

**COG/COOP**--Used in support of Continuity of Government/Continuity of Operations during emergency situations and COG/COOP training and exercises.

**EARTHQUAKE MONITORING**--Used for monitoring and collection of information regarding movement of the Earth due to the rupture of geologic faults.

**EXECUTIVE**--Used by the top echelon leadership of a government agency (e.g. normally used at department level and above where strategic policy is formulated).

**FIRE**--Used to notify the presence of a fire, or to direct, control, or coordinate the operations of fire response vehicles, equipment, and personnel during fire suppression or fire prevention activities.

**HYDROLOGIC**--Used for collection of information regarding the waters of the Earth and its atmosphere, or for the control and management of these waters.

**INSPECTION**--Used during brief and infrequent visits to field sites and installations by inspection teams (e.g. operational readiness inspections, facility evaluations, Inspector General visits, etc.).

**LAW ENFORCEMENT**--Used to direct, control, or coordinate the activities of personnel engaged in law enforcement duties (e.g. building and installation security, criminal investigations, police activities, intelligence and counter-intelligence operations, intruder detection, etc.).

**MAINTENANCE**--Used to support maintenance activities (e.g. resurfacing of roads, maintenance of power lines, repair of dams or bridges, etc.).

**MEDICAL**--Used to direct, control, or coordinate the activities of medical personnel and emergency response vehicles.

**MISC (Miscellaneous)**--Used to support a function not shown elsewhere on this list. (Note: See subparagraph (9) above for additional instructions.)

**MOBILE TELEPHONE**--Used to provide an interconnection between vehicular radios and landline systems.

**NATURAL RESOURCES**--Used for the management, protection, and conservation of natural resources (e.g. national forests, public lands, wildlife, etc.).

**NAVAIDS**--Land stations used to furnish navigational assistance to aircraft and/or ships (e.g. instrument landing systems (ILS), non-directional beacons (NDB), long-range navigation (LORAN), racons, etc.).

**NAVAIDS CONTROLS**--Used to activate and deactivate visual or electronic navigational aids (e.g. runway lights, radio beacons, unmanned lighthouses, etc.).

**PAGING**--A one-way communications system used for selective calling of personnel. (Note: Although paging systems may be used in direct support of functions shown on this list, such as EXECUTIVE or MEDICAL, all paging assignments shall show PAGING as the function name.)

**POSTAL OPERATIONS**--Used to support the collection, processing and delivery of the U.S. Mail.

**RDTE SUPPORT**--Used for communications support of research, development, test, and evaluation (RDT&E) programs and projects. (These frequency assignments do not have an experimental station class.)

**SEISMIC**--Used to transmit measurements of stress, strain, or movements of the Earth's crust.

**SHORT TERM INCIDENT RESPONSE**--Used to respond to short term emergency situations contained within a localized coordination area (e.g. hostage negotiation, bomb threats, locally contained disasters, etc.), and kept in service only for the duration of the incident.

**SPECIAL COURIER**--Used by personnel engaged in transporting valuable, sensitive, hazardous, or classified material.

**SPECIAL PROJECTS**--Used in support of communications electronics systems that are generally one-of-a-kind systems (e.g., Special Forces, intelligence, RF propagation systems, ground and avionics communications-electronics weapons systems, etc.). (Note: See subparagraph (8)(i) above for additional instructions.)

**SURVEY**--Used on an intermittent basis by field survey teams involved in measurement activities (e.g. geodetic surveys, radiation hazard monitoring, pre-construction site surveys, etc.).

**TELECOMMAND**--Used to remotely control the operations of an unmanned vehicle (land, sea, air, or space), or to activate and deactivate instruments or devices carried by the vehicle (e.g. missile destruct, guidance of remotely piloted vehicles (RPVs), control of overhead cranes, etc.).

**TEST RANGE**--Used in support of operations that are unique to a government test range (e.g. range control, range

safety, range timing, etc.).

**TRAINING**--Used to train personnel in the accomplishment of a specific task or set of tasks.

**TRANSPORTATION**--Used to coordinate the routine movement of material and/or personnel from one point to another (e.g. messenger service, supply expeditor, taxi dispatch, etc.).

**TRUNKING**--Radiotelephony using standard land mobile trunking principles.

**UTILITIES**--Used for the management, control, and/or distribution of utilities (e.g. electric power, water, telephone service, oil and gas, etc.).

**WEATHER**--Used for the transmission of meteorological information (e.g. wind speed, temperature, barometric pressure, forecasts, etc.).

**VOLCANO MONITORING**--Used for monitoring and collection of information regarding a rupture in the crust of the Earth that allows lava, ash or gases to escape from magma chambers below the surface.

**WIRELESS MIKE**--A transmitting device used to provide the audio input to a speaker system. (Note: Although wireless mikes may be used in direct support of functions shown elsewhere on this list, such as RDTE SUPPORT or TRAINING, all assignments for these devices shall show WIRELESS MIKE as the function name.)

## **Part 2 - Agency Specific Function Identifiers with Description**

The following list contains standard agency specific function identifiers that have been approved by one or more agencies for use in Major Function Identifier (\*MFI), Intermediate Function Identifier (\*IFI), and Detailed Function Identifier (\*DFI).

**A-EPLRS**--Used in support of the Airborne Enhanced Position Location Reporting System (A-EPLARS), a secure, electronic warfare (EW)-resistant tactical transmission system supporting the Army Tactical Command and Control System (ATCCS) and the Army Battle Command System.

**A2C2S (Army Airborne Command & Control System)**--Used in support of Army Airborne Command & Control System.

**ACS (Aerial Common Sensor)**--Used in support of Intelligence and Electronic Warfare operations.

**AEGIS**--Used in support of AEGIS cruisers and destroyer weapon system operations.

**AERO CLUB**--Used in support of flight training and recreational flying clubs.

**AFATDS**--Used in support of Advanced Field Artillery Tactical Data System.

**AFAUX/CAP (Air Force Auxiliary/Civil Air Patrol)**--Provides Search & Rescue, Disaster Relief, Airborne Reconnaissance, Counter-drug Operations, Contingency Communications Support, and other National Security/Emergency Preparedness (NS/EP) functions.

**AFSATCOM**--Used for voice and/or data transmissions over the AFSATCOM system.

**AHFEWS (Army HF EW System)**--Used in support of Intelligence and Electronic Warfare operations.

**AIR DEFENSE**--Used in supporting those defensive measures designed to destroy attacking enemy aircraft or missiles in the Earth's envelope of atmosphere, or to nullify or reduce the effectiveness of such attack.

**AIR DEFENSE/INTERCEPT**--Used in support of fire finding exercises and operations.

**AIR DEFENSE WARNING**--Used to identify the presence of hostile aircraft and or missiles.

**AIR FORCE ONE**--Used in support of presidential aircraft operations.

**AIR FORCE SPECIAL OPERATIONS**--Used to support AFSOF units (special operations wings and groups, special tactics groups, and special operations weather teams) which provide aircraft and other support for a variety of SOF missions.

**AIR OPERATIONS**--Used in supporting those functions which typically originate from the air and/or directly support the launching of, actual conduct of, and returning of airborne forces carrying out air operations whether over land or sea.

**AIR ROUTE SURVEILLANCE RADAR**--Used for radar's that monitor aircraft routes.

**AIR/GROUND/AIR COMMUNICATIONS**--Used supporting voice and/or data transmissions between airborne and ground-based platforms.

**AIR/AIR COMMUNICATIONS**--Used in supporting voice and/or data transmissions between two airborne platforms.

**AIRBORNE COMMAND CENTER**--Used by airborne command post aircraft in support of the national authority or Combatant Commands.

**AIRCRAFT**--Used in supporting air operation under the jurisdiction of the Department of the Army.

**AIRPORT SURVEILLANCE RADAR**--Used for general coverage radars that are located at airdromes.

**ALARM SYSTEMS**--Used for physical security (e.g., Sensors, Motion Detectors, Intrusion & Duress Alarms, Etc.).

**AMPS (Air Movement Planning System)**--Used in support of Air movement operations.

**AMSS (Automatic Meteorological Sensor System)**--Used in support of Intelligence and Electronic Warfare operations.

**ANTI-TERRORISM**--Used in direct support of anti-terrorism.

**APPROACH CONTROL**--Used to provide a pilot conducting flight in accordance with instrument flight rules to commence an approach to an airport.

**APRS Weather Station**—Automatic Position Reporting System (APRS) weather station provides highly accurate and timely measurements of wind speed and direction, barometric pressure, humidity, temperature, and rainfall.

**AQF (Advanced Quick Fix)**--Used in direct support of command and control, fire control nets, also used for ground surveillance, counter/mortar, and counter/battery operations.

**ARL (Aerial Reconnaissance-Low)**--Used in support of Intelligence and Electronic Warfare operations.

**ARMY AVIATION**--Used in supporting the operation of fixed and rotary-winged aircraft maintained by the Army; includes but is not limited to attack helicopters, scout helicopters, and utility aircraft.

**ARMY SPECIAL OPERATIONS**--Used to support Army SOF units (civil affairs, psychological warfare, and ranger/special forces) which are assigned a variety of SOF missions.

**ARTILLERY**--Used to provide internal command, control, and communications to division and below for fire support.

**ARTS (Automated Remote Tracking System) (Telemetry)**--Used in conjunction with the Space Ground Link Subsystem (SGLS).

**ASAS (All Source Analysis System)**--Used in support of Intelligence and Electronic Warfare operations.

**ASOS (Automated Surface Observation System)**--Used for the collection of weather information used by civil and military aircraft.

**ASW (Anti-Submarine Warfare)**--Used in support of anti-submarine warfare operations.

**ATFP**--Communications used in supporting fleet Anti-Terrorism Force Protection.

**ATIS (Auto Terminal Information Service)**--Used for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

**AVENGER-STC**--Used in support of Short Range Air Search Radar (Stringer) operations.

**AWACS**--Used in supporting special DoD airborne early warning aircraft that are equipped with search and height-finding radar and communications equipment for controlling weapon systems and performs the air surveillance and control mission.

**AWOS (Automatic Weather Observing System)**--Observes weather conditions at specific locations and transmits continuously to aircraft in the area.

**BASE OPERATIONS**--Used in supporting the operations of an Air Terminal; a facility on an airfield that functions as an air transportation hub and accommodates the loading and unloading of airlift aircraft and the in-transit processing of traffic.

**BATTLE COMMAND**--Used in support of command, control, and communications, tactical Internet, and Warfighter Information Network/Satellite networks.

**BEACON**--Used in supporting Marker Beacons, Aeronautical Radio Beacons, and Radar Beacons for radio navigation land stations.

**BLUE ANGELS**--Used in support of the Navy Blue Angels demonstration team.

**BMDS (Ballistic Missile Defense System)**--Joint integrated and multilayered system defending the U.S. deployed forces and allies against ballistic missiles by engaging them in boost, mid-course and terminal phases of flight.

**BMEWS (Ballistic Missile Early Warning System)**--Used in DoD's electronic system for providing detection and early warning of attack by enemy inter-continental ballistic missiles.

**BROADCAST**--Used to support broadcasting signal via Television and/or Radio service.

**C3 (Command, Control, & Communications)**--Used in supporting those strategic, inter-/intra-theater, or inter-/intra service C3 functions NOT already covered under another category.

**CARS (Contingency Airborne Reconnaissance System)**--Used in support of Airborne Reconnaissance operations.

**CAVALRY**--Used in supporting those ground elements whose missions are reconnaissance, security, and economy of force; to find the enemy, to develop the situation and to provide the commander with reaction time and security.

**CBR (Chemical, Biological, Radiological)**--Chemical, biological and radiological teams that respond to terrorist incidents in order to assist local, state, or federal agencies in the conduct of post-incident mitigation actions.

**CID**--Used in support of U.S. Army (Criminal Investigation Command) CID operations.

**CCMD/GENERAL/FLAG OFFICER SPT**--Used in support of command and control and supporting Combatant Commands/General and Flag Officers.

**CIVIL AFFAIRS**--Used for command activities centered on relationship between military forces and civil authorities and citizens in a friendly or occupied country or area. Command performance of certain functions or exercise of certain authority normally the responsibility of the local government.

**CIVIL DISTURBANCES**--Used to support civil disturbance operations.

**CIVIL ENGINEERING**--Used to support civil engineering activities.

**CIVIL SUPPORT TEAM**--Mobile support teams deploying to support national emergencies and natural disasters.

**CIVIL WORKS**--Used to support civil works activities.

**CIWS (Close-In Weapons System)**--Used in support of weapon system.

**CLEARANCE DELIVERY**--Used by air traffic control tower staff to communicate departure instructions to air crews while the aircraft are still on the ground.

**CLOSE AIR SUPPORT (CAS)**--Used in supporting air action by fixed and rotary-wing aircraft against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces.

**COLOR/HONOR GUARD**--Used to support military color guard/honor activities.

**COMBAT CONTROL TEAM**--Used in support of Intelligence, Maneuver, Fire Support, Air Defense, Mobility and Survivability, Logistics and Battle Command.

**COMMAND AND CONTROL**--Used for command and control of military operations.

**COMMAND DESTRUCT/TERMINATION**--Used by range safety officers to destroy errant missiles or UAVs.

**COMMAND NET**--Used for command and control of the Commanders Net.

**COMMAND POST**--Used in supporting Command, Control, and Communications at the Command Post (CP).

**COMMAND POST/CENTER**--Used in supporting Command, Control, and Communications at the Command Post (CP).

**COMMUNICATIONS**--Used in supporting the collection by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy or supporting the passing of data concerning the communications characteristics of a particular area.

**COMMUNITY ASSISTANCE**--Used to support non-specific community assistance activities.

**CONSEQUENCE MANAGEMENT**--Used to support U.S. government interagency assistance to protect public health and safety, restore essential government services, and provide emergency relief to governments, businesses, and individuals affected by the results of a terrorist incident involving weapons of mass destruction.

**CONSERVATION**--Used to support resources conservation activities.

**COUNTER DRUG**--Used in direct support of counter drug operations.

**CSSCS (Combat Service Support Control System)**--Used by computer software system designed to assist commanders in the planning of logistics operations.

**CTT (Commander's Tactical Terminal)**--Used to support Command Post operations.

**DATA COLLECTION PLATFORM**--Used to monitor the environment through the transmission of observations from surface-based platforms to NOAA satellites.

**DATA LINK**--Used in support of the operation of a data link.

**DBRITE (Digital Bright Radar Indicator Tower Equipment)**--Used for DBRITE operations.

**DEPARTURE CONTROL**--Used in controlling aircraft departing from airdromes until they are turned over to air route controllers or go on visual flight rules.

**DIS (Defense Investigative Service)**--Used by DIS organizations.

**DISASTER PLANNING**--Used in direct support of disaster operations.

**DMSP (Defense Meteorological Satellite Program)**--Used in direct support of the Defense Meteorological Satellite Program.

**DOMESTIC SUPPORT OPERATIONS**--Used for various types of military support provided to federal, state, and local agencies in the areas of disaster assistance, environmental assistance, law enforcement, and community assistance.

**DRONE CONTROL**--Used in direct support of drone control operations.

**DSCS (Defense Satellite Communication System)**--Used for voice and/or data transmissions over the Defense Satellite Communication System.

**DTSS (Digital Topographic Support System)**--Used in direct support of DTSS operations.

**EDUCATION**--Used for military education activities.

**ELECTRONIC WARFARE**--Used in supporting the collection by visual observation or other detection methods,

information about the activities and resources of an enemy or potential enemy or supporting the passing of data concerning the electronic characteristics of a particular area.

**EMERGENCY COMMUNICATION**--Used in the support of aviation for distress or emergency conditions.

**EMERGENCY SERVICES**--Used in support of non-specific emergency services.

**EMWIN**--Emergency Managers Weather Information Network, used to provide a near-real-time round-the-clock digital data feed which is disseminated by radio, satellite and Internet broadcasts, and is intended for emergency managers and public safety officials who need timely weather information to make critical decisions.

**ENGINEERS**--Used in supporting Engineers that perform construction, demolition, surveying, road and bridge building.

**ENVIRONMENTAL**--Used to support environmental controls, surveys, and research operations.

**ENVIRONMENTAL CLEANUP**--Used to support environmental cleanup operations.

**EOD (Explosive Ordinance Disposal)**--Used in supporting EOD during destruction or demolition operations. This includes EOD robotic devices.

**EPLRS (Enhanced Position Location Reporting System)**--Used in support of EPLRS system.

**EQUIPMENT CHECKS**--Used to support equipment checks made prior to commencing normal operations.

**ERCS (Emergency Rocket Communications Systems)**--Used to support the Emergency Rocket Communication System or ECM Resistant Communications System.

**ETCAS (Enhanced Traffic Collision Avoidance System)**--Used by aircraft equipped with the ETCAS equipment.

**ETRAC (Enhanced Tactical Radar Correlator)**--Used to support tactical Radar operations.

**EXERCISE**--Used in supporting a military maneuver or simulated wartime operation involving planning, preparation, and execution.

**EXPERIMENTAL**--Used in supporting activities that require an experimental station class.

**FAADC2 (Forward Area Air Defense, Command and Control)**--Used for forward air defense operations.

**FEEDER CONTROL**--Feeder control transitions aircraft from the en route structure to the initial approach fix for landing.

**FEMA (Federal Emergency Management Agency)**--Used to support FEMA (Federal Emergency Mgt Agency) operations.

**FIRE ALARM**--Used in support of emergency fire-alarm systems.

**FIRE SUPPORT**--Used to support artillery in support of infantry, armored, airborne, and airborne mobile operations.

**FLEET SUPPORT**--Used to support fleet units/shore facilities.

**FLIGHT FOLLOWING**--Issues information and advisories to arriving, departing, and en route aircraft and monitors the flight progress of aircraft. Additionally, flight following posts and relays flight progress reports and posts information to flight data strips, boards, charts and maps.

**FLIGHT INFORMATION**--Used for providing aviation weather, advisory service, and other operational data to aircraft.

**FLIGHT INSPECTION**--Normally accomplished FAA flight check aircraft to determine if specific navigation aids (NAVAIDS) such as NDB, VOR, and TACAN are functioning properly.

**FLIGHT TEST**--Used to support flight test operations.

**FLOOD WARNING SYSTEM**--Provides flood warning information in the event of rain and or river/stream/creek overflow.

**FLTSATCOM (Fleet Satellite Communications)**--Used for voice and/or data transmissions over the FLTSATCOM system.

**FORACS (Fleet Operational Readiness Accuracy Check Site)**--Used to support Fleet Operational Readiness Sites.

**FORWARD AIR CONTROL POST**--Used in supporting a highly mobile USAF tactical air control system radar facility subordinate to the control and reporting center and or control post used to extend radar coverage and control in the forward combat area.

**GBAS (Ground Based Augmentation System)**--Provides terminal area precision approach and positioning services that augments the Global Positioning System (GPS) signal.

**GBCS-L (Ground Based Common Sensor-Light)**--Used to support the ground based sensor system.

**GBS (Global Broadcast System)**--Used for voice and/or data transmissions over the Satellite system.

**GCA (Ground Control Approach)**--A radar approach system for aircraft arriving at an airfield.

**GCCS (Global Command and Control System-Army)**--Used to support GCCS operations.

**GLOBAL**--HF frequencies assigned to DOD global communications network.

**GLOBAL ALE (Automatic Link Establishment)**--Used in supporting ALE operations within the DOD global communications network.

**GLOBAL BLACK**--Used in support of the USAF Global HF Network for a non-secure email net.

**GLOBAL DISCRETE**--Unpublished (non-FLIP) HF frequencies assigned to DOD global communications network.

**GLOBAL RED**--Used in support of the USAF Global HF Network secure email net.

**Ground Missile Defense (GMD)**--Communications used in supporting Anti-Terrorism Force Protection.

**GOES (Geostationary Operational Environmental Satellites)**--GOES is a series of meteorological geostationary orbiting satellites that provide weather prediction data for the Western Hemisphere and particularly for the U.S.

**GOLDEN KNIGHTS**--Used by the Army's Golden Knights demonstration team.

**GPS (Global Positioning System)**--Used for precise positioning/navigation information.

**GRCS (Guardrail Common Sensor)**--Used in support collection and location system.

**GRIZZLY (M1 Bleacher MineSweeper)**--Used to support mine sweeping operations using CNR.

**GROUND CONTROL**--Used in supporting those functions which controls originate from the ground and directly support ground-based operations.

**GROUND INTERDICTION**--Used to support ground operations, convoy, scouting, surveillance etc.

**GROUND OPERATIONS**--Used in supporting those functions which originate from the ground and directly support ground-based operations.

**GSR (Ground Surveillance Radar)**--Used to support ground surveillance radar operations.

**H-ENROUTE (High Enroute Communications)**--Used for air traffic control operations between departure and destination terminal areas in the high altitude stratum.

**HAARP (High Frequency Active Auroral Research Program)**--A scientific endeavor to study the properties and behavior of the ionosphere to understand its use to enhance communications and surveillance systems for both civilian and military purposes.

**HARBOR-PORT OPERATIONS**--Used for controlling movements of ships in harbors and ports.

**HAVE QUICK**--Used in supporting DOD's Jam-resistant UHF Communications Radio.

**HAZARDOUS MATERIAL RELEASE**--Used to support hazardous material release.

**HAZMAT (Hazardous Materials)**--Used to support operations dealing with hazardous materials.

**HELO CONTROL**--Used to control and coordinate helicopter transit between ships.

**HICOM (High Command)**--Used to support CINC HF high command net.

**HYDRA (Hierarchical Yet Dynamically Reprogrammable Architecture)**--Used in support of various shipboard voice communications requirements.

**IEWCS (Intelligence Electronic Warfare Common Sensor)**--Used in support of Intelligence and Electronic Warfare operations.

**IFF/SIF**--Used to support Identification Friend or Foe/Selective Identification Features activities.

**ILS (Instrument Landing System)**--Used to support localizer and glideslope aircraft Instrument Landing Systems.

**IMETS (Integrated Meteorological System)**--Used to support the collection of weather reports.

**INDUSTRIAL CONTROLS**--Used to support industrial controls.

**INFANTRY**--Used in supporting those ground-based elements designed to close with and destroy the enemy and which serve as a key element of combat power in close combat.

**INSTALLATION PA SYSTEM (Giant Voice)**--Used by installation public address systems.

**INSTRUCTOR/STUDENT TRAINING**--Used in supporting those activities during training which originate from the class room instructions. Mainly used for training purposes.

**INTELLIGENCE**--Used in support of the gathering of intelligence information.

**INTERPLANE**--Used between aircraft in flight.

**INVENTORY/INVENTORY CONTROLS (e.g., Optical Scanners)**--Used in support of gathering inventory data at exchange, supply, and other logistical type facilities.

**IONOSPHERIC SOUNDER**--Used in support of ionospheric sounder operations.

**I-REMBASS (Improved-Remotely Monitored Battlefield Sensor System)**--Used to support ground surveillance operations.

**ISYSCON (Integrated System Control)**--Used to manage multiple tactical communications systems.

**JSS (Joint Surveillance System)**--Used in supporting the Joint Surveillance System Radars.

**JTIDS/MIDS (Joint Tactical Information Distribution System)**--Used in support of the operation of JTIDS. Used in support of the operation of Link 16 Command and Control Tactical Data Systems. Also known as TADIL-B.

**L-ENROUTE (Low Enroute Communications)**--Used for air traffic control operations between departure and

destination terminal areas in the low altitude stratum.

**LAND WARRIOR**--Used to support combat net radio operations for Corps and below.

**LEASAT (Leased Satellite)**--Used for voice and/or data transmissions over the LEASAT system.

**LINEBACKER**--Used to operate in forward combat areas, the Linebacker is capable of shooting down rotary and fixed-wing aircraft, as well as cruise missiles.

**LLDR (Lightweight Laser Designator Rangefinder)**--Used in support of range finding operations.

**LMRDFS (Light Man-portable Radio Direction Finding System)**--Used to support direction finding system.

**LOCAL CONTROL**--Used by air traffic controllers in the vicinity of an airdrome.

**LOCKS AND DAMS**--Used in direct support of the operation of locks and dams.

**Longbow (Apache Helicopter)**--Used by the weapons radar on Apache helicopters.

**LOOTING PREVENTION**--Used in direct support of looting prevention.

**M93A1 FOX**--Used to support Bridge operations.

**MARS (Military Affiliated Radio System)**--Used for voice and/or data transmissions over the Military Affiliated Radio System.

**METEOROLOGICAL**--Used in supporting the collection by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy or supporting the passing of data concerning the meteorological characteristics of a particular area.

**MFCS (Mortar Fire control System)**--Used to support command and control of Mortar Fire Control operations.

**MICROWAVE**--Used to support Microwave data links.

**MICROWAVE DATA LINK**--Used in supporting the microwave data links.

**MILITARY POLICE**--Used to support security operations, military laws, orders and regulations, traffic control, crime prevention, investigations, logistics, coordination, and planning of police functions.

**MILSTAR (Military Strategic and Tactical Relay System)**--Used for voice and/or data transmissions over the MILSTAR system.

**MISSILE**--Used in supporting electronic fire distribution system designed for CONUS use in coordinating all elements of air defense from target detection to target destruction.

**MITT/DTES (Mobile Integrated Tactical Terminal/Distributed Common Ground System Test and Evaluation Strategy)**--Used to support mobile tactical terminal.

**MLRS (Multiple Launch Rocket System)**--Used to support the flight parameters of its main carrying missiles and submissiles.

**MLS (Microwave Landing System)**--Used to support Microwave Landing Systems.

**MOMS (Man on the Move System)**--Used in support of Man on the Move System operations.

**MOTOR POOL**--Used to support the motor pool.

**MSE (Mobile Subscriber Equipment)**--Used to provide secure, automatic digitized voice, data, and facsimile communications to the users, whether static or mobile operations.

**MTS (Movement Tracking System)**--Used to support the movement of personnel and equipment.

**MUNITIONS**--Used in support of the storage or movement of munitions.

**MUTUAL AID**--Used for fire, medical, police, and other emergency services between federal, state and local agencies.

**MYSTIC STAR**--Used to support the President of the U.S. and senior federal executives.

**NAOC (National Airborne Operations Center)**--Used in direct support of NAOC operations.

**NASA**--Used in support of NASA operations.

**NAVAL GUNFIRE SUPPORT**--Used in direct support of Naval Gunfire Support Operations.

**NAVIGATION RADAR**--Used for radar navigation in reduced visibility to assist the operator in determining the range and bearing to obstructions (e.g., other craft or buoys), avoiding obstacles, avoiding collisions, accessing the bank of a river or shore, and as an aid to maintain a vessel in a channel to avoid running aground.

**NAVY SPECIAL OPERATIONS**--Used for special, focused warfare operations conducted by Navy Sea, Air, Land (SEAL) teams, SEAL Delivery Vehicle Teams, and Special Boat Units (SBU) under the cognizance of the Naval Special Warfare Command.

**NCIS (Naval Criminal Investigative Service)**--Used by Naval Criminal Investigative Service organizations.

**NDB**--A signal (beacon) transmitting on a select frequency which is used by aircraft to determine their location in relation to the beacon signal. May serve as a guide to an airfield or location.

**NERON (NOAA Environmental Real-Time Observation Network)**--RF links are used to establish two-way (simplex) communications to poll data collection platforms (DCP) for MESONET data via base stations and repeater stations as applicable. The DCPS reply by transmitting the hydrometric data.

**NEXRAD**--Used in support of the Next Generation Weather Radar (NEXRAD).

**NOAA WEATHER RADIO**--Used for the dissemination of National Oceanic and Atmospheric Administration weather forecasts, weather warnings, and other critical information to the public.

**NOAA WEATHER RADIO LINK**--A simplex UHF radio link carrying the NWR broadcast from the Weather Forecast/Satellite Office (WFO/WSO) to the VHF transmitter. This radio link is used when a telephone line is unavailable.

**NORAD (North American Air defense Command)**--Used by the North American Air defense Command.

**NTDR (Near Term Digital Radio)**--Used to support the Army's data communication backbone for platoon to brigade.

**OCCS SUPPORT**--Used for communications support of Observer Controller Communication System (OCCS) programs and projects.

**OSI (Office of Special Investigation)**--Used by Office of Special Investigation organizations.

**OTHER OPERATIONS**--Used in supporting those functions not covered in one of the categories listed herein. (Note: See subparagraph (8) (j) above for additional instructions.)

**OTHR/ROTHR (Over-the-Horizon Radars)**--Used in supporting the OTHR. Some systems are relocatable.

**PAR (Precision Approach Radar)**--Used for Precision Approach Radar operations.

**PATRIOT**-- An air defense missile system.

**PAVE PAWS (Precision Acquisition Vehicle Entry Phased Array Warning System)**--Used in supporting the Precision Acquisition Vehicle Entry Phased Array Warning System.

**PILOT-TO-DISPATCHER**--Used between the base operations dispatcher and air crews.

**PILOT-TO-METRO**--Used between the base weather facility and air crews.

**PILOT-TO-PILOT**--Communication between air crews in flight.

**POL (Petroleum, Oil, and Lubricants)**--Used to support POL activities during exercises and operations.

**PRIME BEEF**--Used in support of the Prime Beef construction team.

**PRISON BUS**--Used for immediate communications support to prison and/or local police units during the transport of federal prisoners between federal correction facilities, other transportation media, medical facilities, and/or U.S. Courts.

**PROJECT COTHEN**--Federal Anti-Drug Operations.

**PSYCHOLOGICAL OPERATIONS**--Used for planned psychological activities in peace and war directed to enemy, friendly and neutral audiences to influence attitudes and behavior affecting achievement of political and military objectives.

**PUBLIC WORKS**--Used to support public works.

**RADAR (Radio Detection and Ranging)**--Used to support the various types of radar functions.

**RADIO RELAY**--Used in supporting signal communication system using very high frequencies and line of sight radio transmitters and receivers in lieu of trunk wire circuits. This system, when used in conjunction with carrier equipment, will provide channels for both voice and Teletype operations.

**RADIOLOCATION**--Used in supporting the determination of relative direction, position, or motion of an object, or its detection, by means of the constant velocity of rectilinear propagation characteristics of radio waves.

**RADIOSONDE**--Airborne instrumentation platform for collection/transmission of atmospheric temperature, pressure, relative humidity, and wind speed and direction data. Data is used to provide a three-dimensional picture of atmospheric conditions, which is essential for weather forecasting and meteorological research.

**RAMP CONTROL**--Used to control the movement of aircraft and vehicle traffic on the flight line.

**RANGE CONTROL**--Used in supporting the Range Control functions on a DOD Range (e.g., Range scheduling).

**RANGE OPERATIONS**--Used in supporting general operations on a DOD Test Range or Military Training.

**RANGER UNITS**--Used in supporting those units that plan and conduct special military operations and have the ability to support conventional military operations.

**REMOTE MAINTENANCE MONITORING**--Used for the remote collection of radio system status and operational data for remote review and analysis.

**RDMS (Range Data Management Subsystem)**--Used to support the RDMS currently being used at the National Training Center (NTC).

**RED HORSE**--Used in support of Air Force tactical construction operations.

**REFUELING**--Used in supporting voice communications in support of air-air refueling operations.

**REMOTE BARRIER CONTROL SYSTEMS**--Used to control aircraft barrier systems.

**REMOTE CONTROL CRANE**--Used to control remotely controlled cranes such as in a shipyard, harbor or other major industrial facilities.



**RESOURCES CONSERVATION**--Used to support resource conservation research operations.

**RESUPPLY**--Used in support of re-supply operations.

**RF TAGS**--(Radio Frequency Tags and Interrogators)--Logistics and shipping container tracking and management devices.

**RUNWAY ICE DETECTION SYSTEMS**--Used to monitor runway ice detection systems.

**RUNWAY LIGHTING CONTROL**--Used to control remotely controlled runway lighting.

**RVR (Runway Visual Range)**--Used for the measurement of atmospheric transmissivity along airport runways.

**SAFETY**--Used in support of public works safety net.

**SATELLITE COMMUNICATIONS**--Used for voice and/or data transmissions over a non-specific satellite system.

**SAWDS (Satellite Automated WX Dist Sys)**--Network to disseminate weather information to DOD facilities.

**SCAMP (Single Channel Anti-Jam Manportable Terminal)**--Used to support voice and data links for battle command and control communications.

**SCOPE SHIELD**--Tactical handheld radios.

**SEA OPERATIONS**--Used in supporting those functions which originate from on board ship and/or directly support the launching of, actual conduct of, and returning of forces carrying out sea-based operations; operations in a maritime and littoral environment which contribute to gaining and maintaining freedom of action.

**SEABEES**--Used in support of SEABEES construction activities.

**SEARCH AND RESCUE**--Used in supporting Search and Rescue (SAR) operational use of aircraft, surface craft, submarines, specialized rescue teams and equipment to search for and rescue personnel in distress on land or at sea.

**SECURITY FORCE**--Used in providing installation physical security operations.

**SENTINEL (AN/MPQ-64 Surveillance Radar)**--Used for air surveillance and target acquisition/tracking sensor for Short Range Air Defense (SHORAD) weapons systems.

**SGLS (Space Ground Link Subsystem) (Telemetry)**--Used in conjunction with the Automated Remote Tracking System (ARTS).

**SH-ENROUTE (Super High Enroute Communication)**--Used for air traffic control operations between departure and destination terminal areas in the super-high altitude stratum.

**SHIP/AIR OPERATIONS**--Used in supporting airborne units assigned to US Naval ships.

**SHIP/SHIP**--Used in supporting ship-to-ship communications.

**SHIP/SHORE OPERATIONS**--Used in supporting ship-to-shore and shore-to-ship communications.

**SHIPYARD**--Used in supporting shipyard operations, except remote controlled cranes.

**SHORE PATROL**--Used by shore patrol activities.

**SHUTTLE**--Used in direct support of Space Shuttle operations.

**SIMULATOR**--Used to support simulator activities.

**SINGARS (Single Channel Ground and Airborne Radio System)**--Used to support combat arms command and control operations.

**SINGARS-ASIP (Single Channel Ground and Airborne Radio System-Advanced System Improvement Plan)**--Used to support combat arms command and control operations.

**SNOW REMOVAL**--Used to support snow removal activities.

**SOF (Supervisor of Flying)**--Used by the SOF to assist pilots.

**SONOBUOY**--Used for floating electronic sensors designed to provide various data for Navy antisubmarine warfare (ASW).

**SORT (Special Operations Response Team)**--Used by federal officers specially trained in controlling disturbances within U.S. Penitentiaries or other federal correctional facilities.

**SPACE OPERATIONS**--Used in supporting those functions that directly support operational space missions including satellite control and shuttle missions.

**SPECIAL FORCES**--Used for specially trained, equipped and organized force against strategic or tactical targets in pursuit of national military, political, economic, or psychological objectives. These operations may be conducted during peace or hostilities. They may support conventional operations, or be prosecuted independently when use of conventional forces is inappropriate or infeasible.

**SPECIAL OPERATIONS**--Used in directly supporting Special Operations; those operations conducted by specially trained, equipped, and organized DOD forces (e.g., SOF) against strategic or tactical targets during peacetime or during hostilities.

**SPECIAL SECURITY OPERATIONS**--Used in direct support of special security operations.

**SPEED MEASUREMENT SYSTEMS**--Used by law enforcement activities to measure the speed of vehicles.

**SPITFIRE (SPITFIRE Manpack UHF SATCOM DAMA Terminal)**--Used to support digital voice communications.

**SQUADRON/WING COMMON**--A common frequency used for communication within a squadron or wing; (AF) a unit composed normally of one primary mission group and the necessary supporting organizations; (Navy) the basic organizational and administrative unit for naval, land, and tender-based aviation; (Marines) a balanced task organization of aircraft groups/squadrons together with appropriate command, air control, administrative, service, and maintenance units.

**STRIKER II (Advanced Fire Support/Scout/Surveillance System)**--Used to support long-range, reconnaissance, surveillance and fire support systems.

**SUPPLY AND LOGISTICS**--Used to support general supply and logistics operations.

**SURFACE NAVAIDS**--Ship stations used to furnish navigational assistance to aircraft and/or ships.

**SURVEILLANCE/ RECONNAISSANCE**--Used in supporting those strategic and tactical sensors and systems which provide warning of air breathing, ballistic missile, space-based, or tactical ground-based attack or to relay voice and/or data on the activities and resources of a potential or real enemy or the characteristics of a particular area obtained through visual observations or other detection methods.

**SURVEILLANCE SYSTEMS**--Used to support base security surveillance operations.

**SUSTAINING OPERATIONS**--Used in supporting those functions normally performed in conjunction with the continued operation of an Army Post, a Navy/Marine Corps Base, or an Air Force Base.

**TACAN (Tactical Air Navigation)**--Used by TACAN systems.

**TACCS (Tactical Army Combat Service Support Computer System)**--Used in support of the TACCS.

**TACJAM (Tactical Communications Jamming System)**--Used to support jamming operations.

**TACTS (Tactical Trunk Signaling)**--Used to support trunking systems.

**TADIL-A**--Used in support of the operation of Link 11 Naval Tactical Data System (ship to ship and ship to air) operations. Also used by the USAF for air to ground operations.

**TADIL-C**--High Frequencies (HF) used in support of the operation of Link 11 Naval Tactical Data Systems (ship to ship and ship to air) operations.

**TARGET**--Used to support target scoring and precision tracking radar etc.

**TARGET ACQUISITION**--Used within a system that identifies valid targets.

**TARGET SCORING**--Used to support target scoring of laser equipment.

**TAXI**--Used by base/installation taxi systems.

**TCAS (Traffic Collision Avoidance System)**--Used by aircraft equipped with the TCAS equipment.

**TCRS (Target Control System)**--Used to support target control functions and exercises at NTC.

**TEAMMATE**--Used to support collection and direction finding systems.

**TECHNICAL ESCORT UNIT**--Used to support a technical escort unit which is a deployable explosive and chemical/biological response team that identifies, escorts, decontaminates, disposes and mitigates explosive chemical and biological devices.

**TELEMETRY**--Used in supporting the transmission of telemetry data on a DOD range.

**TEST AND MEASUREMENT**--Used in supporting the test and measurement functions on a DoD Range.

**TEST RANGE TIMING**--Used in supporting the transmission of timing signals on a DOD Range.

**TETHERED AEREOSTAT RADAR**--Used in supporting the Tethered Aerostat Radars and interface system.

**THUNDERBIRDS**--Used by the USAF Thunderbirds demonstration team.

**TIS or TRAVELERS INFORMATION SYSTEM**--Used to provide travelers advisories.

**TMGS (Transportable mobile ground subsystems)**--Used in support of telecommand operations.

**TOSS (TV Ordnance Scoring System)**--Used in support of telecommand operations in scoring target accuracy on military ranges.

**TOWER**--Controls aircraft within assigned airspace and aircraft/vehicles on ground at airfields.

**TRACKWOLF**--Used to support ground based HF skywave communications intercept and direction finding systems.

**TRAILBLAZER (Ground Based Communications Intelligence System)**--Used by the Army to gather Intelligence.

**TROJAN SPIRIT**--Used to support the Transportable Trojan Spirit II satellite communications terminal.

**TSU**--Technical escort unit is a deployable explosive and chemical/biological response team that identifies, escorts, decontaminates, disposes and mitigates explosive chemical and biological devices.

**UAV (Unmanned Aerial Vehicle)**--Used in supporting the testing and/or operations of pilotless aircraft.

**UNLICENSED DEVICE**--Used by the government for use by low power devices normally operated without a license under the provisions of Part 15 of the FCC Regulations.

**VOICE LINK**--Used in the support of a voice radio link.

**VORTAC (VHF Omni-range TACAN)**--Used for VORTAC operations.

**VOR (Very High Frequency Omnidirectional Range)**--Used for Very High Frequency (VHF) Omnidirectional Range (VOR) operations.

**WARNING SYSTEM**--A signal or siren that warns of imminent danger (e.g., bomb alert, chemical, tornadoes, etc.).

**WEAPON SYSTEMS**--Used by major weapon systems.

**WEAPONS STORAGE PROTECTION**--Used to support weapons storage facilities.

**WEATHER RADAR**--Radar frequencies used by aircraft or ground based sites for weather purposes.

**WHCA (White House Communications Agency)**--Used in supporting WHCA operations.

**WIDEBAND GLOBAL SATCOM**--Used for voice, data and/or video transmissions in support of U.S. military operations using the Wideband Global Satcom (WGS) system.

**WILDLIFE PRESERVATION**--Used for game wardens, endangered species/wildlife preservation and tracking the movements of wild animals.

**WIND MEASUREMENT**--Used in the support of wind measurement equipment (direction, speed and/or shear)

**WIND PROFILER**--Used for sensing wind shear in the vicinity of airports.

**WIN-T (Warfighter Information Network-Tactical)**--Used to support the Army's Tactical Intranet consisting of switching/routing/transport that provides voice, data and video services.

**WIRELESS LOCAL AREA NETWORK**--Used to support local area network frequency bands.

**WOLVERINE (Assault Bridge)**--Used to support command and control of bridge operations.

*v. Mexican Coordination Data (\*MEX)*

(1) The information in this field is normally those comments that were added based on FAS ADM 800118, dated June 16, 1980. These comments are:

\*MEX,21311, IRAC, MAR 1980, MAY 1980 GMF

(2) As these comments indicate that this record was provided to Mexico for coordination in the original list, do not delete this entry when updating the assignment. If a record replacement action is used, and the frequency and/or location does not change, the docket numbers of the older authorization should be retained in the circuit remarks (see subparagraph 39g, \*DOC).

(3) Agencies may also use this field to enter coordination comments based upon actual coordination with Mexico.

(4) Use this field by inserting the identifying code REMnn followed by a space, then \*MEX followed by a comma, then the data.

*w. U.S. Coordination Comments on Canadian and Mexican Proposals (\*USA)*

(1) Proposals for frequency coordination from Canada (and at some future date from Mexico) are processed through the automated FAS agenda system. When coordination is completed, the records are added to the GMF with the U.S. coordination comments indicated on the record by the code \*USA followed by NHIA or NHIC.

(a) NHIA means no harmful interference is anticipated either to or from the proposals.

(b) NHIC means no harmful interference is anticipated, but additional information or a noting comment pertinent to the coordination is include.

(2) See Section 9.16.3 for instructions on formatting and voting \*USA comments.

*x. FCC File Number (\*FLN)*

This entry is used to identify an FCC File Number of an application received or license issued to a non-federal entity allowed to use either an NTIA-authorized frequency or a U.S. federal radio station on a frequency licensed by the FCC.

(1) Insert REMnn followed by a space and the identifying code \*FLN followed by a comma.

(2) Immediately following the comma insert the FCC file number.

*y. Name, or Personal Identifier and Position, of Original Classification Authority (\*CLA).*

(1) This field is used to identify, by name, or by personal identifier and position, the original classification authority for classified data. This entry shall be included for all classified applications for which the classification

was originally applied by the applicant and was not determined from derivative methods. This entry shall include all data in a single occurrence.

(2) Enter the field code REMnn followed by a space. Following the space, enter the code \*CLA followed by a comma. Immediately after the comma, enter the name, or personal identifier and position, of the original classification authority, or the statement EXCLUDED,1.6.B, if entry of this information falls under the exclusion provision of Executive Order 13526.

*Example:*

```
REM04 *CLA,ASD,CCCI,DOD
REM02 *CLA,COMDR,12AF,USAF”
REM05 *CLA,JOHN MCCLELLAN,AA,NTIA,DOC
REM03 *CLA,EXCLUDED,1.6.B
```

*z. Derivative Classification Authority (\*CLF).*

(1) This field is used to identify the source document, or classification guide, used as the basis for derivatively classifying data in a frequency assignment. This entry shall be included in all applications that are derivatively classified or contain a declassification instruction of OADR in the data field CDD, and shall be composed such that the source document or classification guide can be readily identified. Use more than one entry if necessary.

(2) Enter the field code REMnn followed by a space. Following the space, enter the code \*CLF followed by a comma. Immediately after the comma, enter the identity of the source document or classification guide. Include the title, date and agency or organization that published the source document.

(3) In those instances where the original classification authority extends a declassification date in the field CDD beyond the initial 10-year period, this field is used to identify the date the declassification was extended, the individual that approved the extension, and that individual's agency or organization. However, entry of this information is not necessary when the classification is derived from another source and the source is listed in accordance with subparagraph (2) above.

*Examples:*

```
REM06 *CLF,ASD,C3I,MEMO,SUBJ WINDOW
REM07 *CLF,3JULY95
*****
REM04 *CLF,B-1B SCG,930815, OC-ALC/LAB
*****
REM10 *CLF,NTIA SCG FOR FREQ ASSIGNMENT
REM11 *CLF,RECORDS,821108, ASCI (NTIA),DOC
```

*aa. Reason for Classification (\*CLR).*

(1) This field is used to cite the category, or categories, of Executive Order 13526, that the original classification authority determined to be the reason(s) frequency assignment data in the assignment must be classified. This entry shall be included in all classified applications, except those classified derivatively, for which entry is optional. If this entry is used, all data shall be entered in a single occurrence.

(2) Enter the field code REMnn followed by a space. Following the space, enter the code \*CLR followed by a comma. Immediately after the comma, enter the code 1.4, followed immediately by one, some, or all of the letters a, b, c, d, e, f or g, or h, which represents the classification categories listed in Executive Order 13526. For multiple category entries, enter the letters in alphabetical order.

*Example:* REM05 \*CLR,1.4ABCD”

*bb. Extended Declassification Date (\*CDE).*

(1) This field is used to enter the declassification date for “permanently valuable” information when the field CDD contains an entry in the range DE25X2 - DE25X9. This entry shall include all data in a single occurrence.

(2) Enter the field code REMnn followed by a space. Following the space, enter the code \*CDE followed by

a comma. Immediately after the comma, enter the declassification date in year, month and day (YYMMDD) order.

*cc. Classified Data Fields (\*CLC or \*CLS).*

(1) These fields are used to identify those data fields in an assignment that are classified confidential or secret. One or both of these entries must be included on all classified applications to indicate the classified information.

(2) Enter the field code REMnn followed by a space. Following the space, enter the code \*CLC to indicate those data fields that are classified Confidential or \*CLS to indicate those data fields that are classified Secret followed by a comma. Immediately after the comma, enter the mnemonic(s) (and occurrence number of multiple occurring fields) of the classified data field(s). If more than one mnemonic is entered, separate each with a comma. You must enter all classified data fields that are confidential in \*CLC and all classified data fields that are Secret in \*CLS.

(3) Use as many entries of \*CLC or \*CLS REM lines as necessary to list all classified data fields.

(4) The entry for Supplementary Details will always be SUP (See paragraph 80, subparagraph j, of this section.).

*Example:* REM09 \*CLC,EMS01,PWR01,EMS02,PWR02,SUP  
REM10 \*CLS,XAD01, RAD03, REM11

*dd. Unclassified Data Fields (\*CLU).*

(1) This field is used to identify those unclassified frequency assignment data fields in a classified assignment. This entry shall be included in all classified applications. This entry shall include all data in a single occurrence.

(2) Enter the field code REMnn followed by a space. Following the space, enter the code \*CLU followed by a comma. Immediately after the comma, enter the statement ALL DATA FIELDS NOT LISTED IN \*CLC or \*CLS if there are unclassified data fields, or the statement NO UNCLASSIFIED DATA FIELDS if there are no unclassified data fields.

*ee. Transition and Planning Data (\*TRN)*

This optional data field may be used to provide the planned date it is anticipated an assignment will be transitioned and to provide the new frequency planned for the operation.

a. Insert the identifying code REMnn \*TRN;

b. Following the identifying code, insert a comma;

c. After the comma, insert in the next six characters the dated, in year, month, day (yyymmdd) order, planned for the transition or narrowing to occur.

d. If the frequency to be transitioned to is known, insert a comma after the date, followed by the new frequency. Enter this data the same way frequency is entered into the data field FRQ.

*Examples:*

REM06 \*TRN, 050630, M416.225  
REM05 \*TRN, 030331

*ff. Paired Frequency (\*PRD)*

This field identifies a repeater station or point-to-point operations using paired transmit or receive frequency, the associated agency serial number and any other information (e.g., repeater input, repeater output) associated with that frequency's assignment. This entry is required for all applications having a station class with the suffix "R" added, meaning the station is to be used primarily as a repeater, and the frequency being applied for is within one of the ranges listed in Section 6.1.2, paragraph 2 or Section 6.1.3, paragraph 2. This entry is also required for any application containing the Circuit Remarks entry "\*RPT" (see paragraph 39h, above). For point to point operations this field applies to all frequency bands above 29890 kHz.

(1) Insert the identifying code REMnn, a space, then \*PRD followed by a comma.

(2) After the comma, insert the repeater station transmit or receive frequency, followed by a comma. The frequency shall be entered with four digits beyond the decimal point (e.g. M39.0125; M166.0000), and shall be preceded by the letter designating the frequency band (e.g. M for mega-hertz)(see Chapter 6, Section 6.2)

(3) After the comma, insert the 10-digit serial number associated with the repeater station receive or transmit

frequency assignment. However, if this field is used and multiple assignments for the repeater station frequency, include only one of those serial numbers as a representative of the group.

(4) (Optional) After a comma, insert associated information (e.g., repeater input, repeater output etc.).

Note: The only characters allowed in this portion of the associated information field are alphabetical, blanks and commas.

*Example:*

```
REM01 *PRD,M166.0125,VA 000622,RPT OUT
REM02 *PRD,M39.0250,NASA010101,RPT IN
REM03 *PRD,M166.0000,NASA060001
```

*gg. Declassification Instructions Comment (\*DIC)*

(1) This field is used to describe the event, when after its occurrence, the data field (CLA) Classification would be changed to U-Unclassified, data field (CDD) Declassification Date would be removed from the record, and any data item classified (C) or (S) would be reclassified to (U). (Note: The responsible agency is required to submit a modification transaction to declassify the assignment once the event described in this data field occurs.)

(2) Enter the field code REMnn followed by a space. Following the space enter the code \*DIC followed by a comma. Immediately after the comma describe the event that is the basis for declassifying the assignment record.

*Example:* REM08 \*DIC, DECLASSIFY AFTER MISSILE LAUNCH

#### **40. Serial Replaced (SRS) and Serial Replaced Expiration Date (SEX)**

##### *a. General Rules*

(1) These two fields may be used to delete from the GMF one or more (maximum of nine) existing assignments simultaneously with a NEW or NOTIFICATION Action. If a New or NOTIFICATION Action is intended as a replacement for existing assignments, an entry for each replaced assignment is made in the SERIAL REPLACED (SRS) field and the SERIAL REPLACED EXPIRATION DATE (SEX) field.

(2) The assignment record to be deleted will be automatically converted to a temporary assignment with an expiration date corresponding to the date entered in the SEX field. It will be printed on the FAS agenda immediately following the new or notified record to which it refers. The new or notified action and the assignment to be deleted will appear in the GMF until the date entered in the SEX field has passed, at which time the latter will be deleted.

(3) Each entry in the SERIAL REPLACED (SRS) field must have a corresponding entry in the SERIAL REPLACED EXPIRATION DATE (SEX) field.

(4) If no assignment record is to be deleted, these fields shall be left blank.

##### *b. Serial Replaced (SRS) (10 Characters--9 Occurrences)*

Enter the identifying code SRSnn followed by the Serial Number of the assignment being replaced as it is shown in the GMF.

*Examples:*      SRS01 AF 761234  
                 SRS09 NASA783456

##### *c. Serial Replaced Expiration Date (SEX) (6 Characters--9 Occurrences)*

Enter the identifying code SEXnn followed by the desired date of deletion in year-month-day order. The date shall not exceed one year from the date of the application.

*Examples:*      SEX01 880615  
                 SEX09 880915

#### **41. FOI-Exempt from FOIA (1 Character-1 Occurrence)**

This field is used for identifying those assignments determined by the submitting agency's Freedom of Information Act (FOIA) Officer to be exempt from release in accordance with the provisions of the FOIA, 5.U.S.C. 552, as amended. By entering X in this field, the agency representative attest the record meets one or more of the criteria

outlined in the provisions of the Freedom of Information Act, 5 U.S.C. 552 as amended. Agency representatives will provide NTIA with justification upon request. Agency representatives will timely update information in this field as changed. The federal agency requesting the frequency assignment should work with its FOIA officials to determine whether the frequency assignment may be withheld under any of the available FOIA exemptions for unclassified records at the time that it requests the assignment.

#### **42-78. Reserved**

#### **79. Frequency Assignment Subcommittee (FAS) (72 Characters--5 Occurrences)**

The FAS field shall be used to provide information that will not be recorded in the GMF. This field is used for information of value only to FAS Representatives and relevant only while the frequency assignment action remains on the FAS agenda. This data will not be recorded in the GMF.

##### *Examples:*

FAS01 THIS IS A RENEWAL OF AN EXISTING AUTHORIZATION.  
FAS03 ROUTINE UPDATE. 5-YEAR REVIEW.  
FAS01 TELEPHONE ACTION RE-QUESTED.  
FAS05 AGA COORD WITH SMITH/NTIA, 8/1/85.

#### **80. Supplementary Details (SUP) (72 Characters-15 Occurrences)**

The SUPPLEMENTARY DETAILS (SUP) data field may contain an explanation of the proposed operation and supplemental data as required below.

a. *Experimental Station Classes:* If the application is for an assignment to an experimental station, insert information to further describe the intent or nature of the experimental operation (see Section 6.4).

b. *Canadian Coordination:*

(1) If Canadian coordination is required or desired, any amplifying data to be forwarded to Canada shall be entered in the SUPPLEMENTARY DETAILS in the following format:

(CANCOR . . . );

##### *Examples:*

(CANCOR USE ALONG BORDER IS OCCASIONAL) (CANCOR REF U.S. SERIAL I8190001)  
(CANCOR NOTE 172.9 MHZ, U.S. SERIAL 760001)

The abbreviation CANCOR must immediately follow the initial parenthetic character. Only the data following "CANCOR" and preceding the closing parentheses sign will be forwarded to Canada.

(2) In addition to any other amplifying data, the following information is to be furnished Canada using the procedure in 80.b.(1) above:

(a) If abbreviations have been used in the transmitter and/or receiver Antenna Location fields, and complete spelling is not readily apparent, enter the complete spelling.

(b) If the frequency has been coordinated previously with Canada for use in the same geographic area, insert the U.S. Serial Number of the previous coordination as it appears on the \*CAN line in the Circuit Remarks of the GMF assignment being cited.

(c) If an expeditious reply from Canada is necessary, insert EXPEDITIOUS REPLY REQUESTED.

(d) If the application is for operations in two or more states along the border and S322 has not been inserted in the NOTES field, insert additional data to inform Canada of the extent to which the frequency will be used.

(e) While an application is Tabled on the FAS agenda during the Canadian coordination process, an agency may use the SUPPLEMENTARY DETAILS (SUP) field to request reconsideration of an adverse comment made

by Canada. On the next available SUP line using the format (CANCOR), an agency shall request reconsideration of the Canadian comment and provide rationale for the request. Agencies may not request reconsideration with a frequency change. To change frequency a new application must be submitted.

*Examples:*

(CANCOR Rqst reconsideration based on 120 kilometer separation)

(CANCOR Rqst reconsideration with antenna changed to 7dB yagi and noting adjacent channel offset of 12.5 kHz)

See Section 9.16 for submitting FAS agenda corrections and changes.

*c. Fixed Station and Transportable Transmitting Earth Station Coordination:*

(1) If the application is for an assignment to a transportable Earth station in the band 7900-8400 MHz or to a fixed (FX) station in the bands 1710-1850, 2200-2290, 4400-4990, 7125-7250, 7300-7975, or 8025-8400 MHz whereby the requirement involves a communications system consisting of more than two stations that are interconnected (excluding stations to be used for transportable operation--Note S362), and a data plot or coordination contour map was circulated, enter the notation "data plot circulated" or "contour map circulated," as applicable in the FAS field (see Section 9.2.4 for details).

(2) If a data plot or coordination contour map was not circulated and successful coordination was effected with all agencies concerned, insert a statement to indicate that this coordination determined data plots and/or coordination contour maps were not required.

*d. Transportable Receiving Earth Station:* If the application is for transportable Earth stations in the band 7250-7750 MHz, insert a statement indicating that power flux density (PFD) at Earth surface will not exceed the limits listed in Section 8.2.36.

*e. Frequency Diversity:* Applications for frequencies to be used in the frequency diversity mode of operation shall contain a statement of justification consistent with the provisions of Section 8.2.25. Frequency diversity applications for each individual radio path shall be cross-referenced by frequency, and the statement of justification shall be included in the SUPPLEMENTARY DETAILS field of each application.

*f. Sounder Stations:* If the application is for a sounder network or a sounder prediction station, insert a statement indicating that it has been determined no existing authorized ionospheric sounder transmitter is capable of meeting the requirement (see Section 8.2.21).

*g. Notification Actions:*

(1) For notification under the authority of Section 7.12, insert information to identify the coordination correspondence with the FCC regarding the proposed operation.

(2) If the application is a notification of a telecommunications laser, describe the function and purpose of the operation.

*h. Emission Symbol Explanation:* If the letter X is used in either of the first, second, or third emission designator symbol(s) (see Section 9.8.2, paragraph 16e(2)(a), (b), and (c)) an explanation of emission characteristics must appear in the Supplementary Details.

*i. Separate System Justification:* For assignments for land mobile systems that are within 30 km of an existing or planned trunked land mobile system authorized by NTIA, provide the information required under subparagraph 8.2.48a.

*j. Classification of Supplementary Details:* NTIA compresses this data field in order to preserve total assignment record size, and the information is treated as a single paragraph. Individual marking of separate line occurrences for the purposes of complying with paragraph 39, subparagraphs cc and dd, is not possible. Therefore, if any of the information entered in Supplementary Details is classified, the entire Supplementary Details entry becomes classified.

*k. All applications:* If the application is for an assignment for a federal agency then it shall contain:

(1) Justification of need (see Section 8.2.4);

(2) A statement by the FAS representative/alternate or headquarters federal employee that the assignment is needed; and

(3) A general explanation of the operation (see Section 9.5).



Example:

SUP01 This base station and mobiles are required for building evacuation and COOP activities which the FAS representative has verified are needed by the agency.

SUP01 This fixed point to point operation is required for transferring data and video which the FAS alternate has verified as needed.

## **9.9 USE OF THE CARD FORMAT FOR MODIFICATION, RENEWAL, AND DELETION ACTION**

1. The card format with the COMMAND CARD “\$\$MOD” is used only with MODIFICATIONS (see Section 9.7.2, paragraph 12, and below).

2. The card format with the COMMAND CARD “\$\$CHG” is used for the following purposes:

a. MODIFICATION (M)--To apply for the addition, substitution, or removal of one or more of the particulars, other than the frequency, the agency serial number, or the transmitter state/country, of an existing frequency assignment which is in the GMF. No more than 60 data fields of a particular assignment can be modified at one time (see Section 9.7.1, (subparagraph C)).

b. RENEWAL (R)--To apply for the extension of the period of a temporary or trial assignment which is in the GMF (see Section 9.6) and to simultaneously update other particulars of the assignment.

c. DELETION (D)--To apply for the cancellation of a frequency assignment and the removal of all its particulars from the GMF.

3. The COMMAND CARD \$\$CHG may not be used to take action on the AGENCY SERIAL NUMBER, the transmitter STATE /COUNTRY, or the FREQUENCY fields.

## **9.10 USE OF FIELD CODES**

Only the following field codes may be used for actions containing a \$\$CHG or \$\$MOD COMMAND CARD. The field code and occurrence number is used to identify the data field(s) which the applicant desires to address (see Section 9.7.1).

Table: Field Codes			
Field Title	Field Code	Field Title	Field Code
Action Number	ACN	Receiver Antenna Location	RAL
Receiving Station Call Sign	ACL	Receiver Antenna Longitude	RLG
Bureau	BUR	Receiver Antenna Polarization	RAP
Circuit Remarks	REM	Receiver Antenna Orientation	RAZ
Classification	CLA	Receiver Control	RRC
Date	DAT	Receiver State/Country	RSC
Declassification Date	CDD	* Review Year	RYR
Emission	EMS	Routine	RTN
Expiration Date	EXD	Supplementary Details	SUP
FOIA	FOI	Station Class	STC
Frequency Assignment Subcommittee	FAS	Time	TME
International Coordination Indicator	ICI	Transmitter Antenna Orientation	XAZ
Missing Data Indicator	MSD	Transmitter Antenna Dimensions	XAD
Net Control	NET	Transmitter Antenna Latitude	XLA
Notes	NTS	Transmitter Antenna Location	XAL
Power	PWR	Transmitter Antenna Longitude	XLG
Power Density	SPD	Transmitter Antenna Polarization	XAP
Receiver Antenna Dimensions	RAD	Transmitter Call Sign	XCL
Receiver Antenna Latitude	RLA	Transmitter Control	XRC
		Type of Action	TYP
*See Annex F and Section 9.15.			

*Example:*

\$\$CHG I 791882  
 TYP01 M  
 DAT01 791105  
 EMS03 20KF2B

indicates that the applicant desires to change the third emission in the GMF record I 791882 to 20KF2B.

## 9.11 PREPARATION OF THE CARD FORMAT FOR A MODIFICATION ACTION

1. Before submitting a Modification action, read Sections 9.7 and 9.9.
2. Assignments which have been previously coordinated with the Canadian Department of Communications pursuant to Section 3.4 may be modified without being re-coordinated with Canada provided the modification will not increase the probability of harmful interference. If the Modification will increase the probability of harmful interference, the assignment must be re-coordinated with Canada.
3. The deletion of an entry in the EMISSION field, in the POWER field, or in the STATION CLASS field, requires that a corresponding deletion be made in the other two fields.
4. Prepare the application for the routine portion of the FAS agenda, according to the instructions below, when the modification:
  - Does not increase the probability of harmful interference, and
  - Does not extend or delete the expiration date.

Enter RTN01 followed by one of the letters A, M, or R:

- Enter A if the assignment is in the AAG band (see Section 9.14.1).

-- Enter M if the assignment is in the MAG band (see Section 9.14.2).

-- Enter R if the assignment is neither in the AAG nor MAG bands. The letter R will be automatically entered by the computer in the ROUTINE field if the following conditions are met:

a. The frequency assignment being modified is not within the AAG or MAG bands (see 9.14.1 and 9.14.2);

and

b. The following fields are modified, added or deleted either alone or in conjunction only with each other:

*AGN	*EQS	*POC	TME
ACL	*EQT	*PRD	XAL
ACN	*FLN	*PRR	XAP <sup>4</sup>
FOI	ICI	RAL	XCL
BUR	*IFI	RAP <sup>4</sup>	XLA <sup>5</sup>
*CAN	*JNT	RLA <sup>5</sup>	XLG <sup>5</sup>
CLA	*MFI	RLG <sup>5</sup>	XRC
DAT	*MEX	RRC	
*DFI	NET	RYR	
*DOC	NTS	SPD	
*EQR	*NTS <sup>6</sup>	SUP <sup>7</sup>	

5. The following card formatting rules apply:

a. Each MODIFICATION requires:

(1) The COMMAND CARD:

\$\$CHG or \$\$MOD (Enter the serial number of the assignment being modified as it is recorded in the GMF)

(2) The TYPE OF ACTION (TYP) Card: TYP01

(3) The DATE (DAT) Card:

DAT01 (Enter the date (year/month/day) on which the application is prepared. Use numeric characters only; leave no blanks.)

(4) The data field and data being modified.

(a) Insert the code for the field being modified in the first three spaces. The codes are listed in Section 9.10. Insert the occurrence number for that portion of the field being modified in the last two spaces, as entered in the GMF. For example, insert EMS02 for the emission shown in the list on the second line of the EMISSION FIELD.

(b) Insert the new data that are to appear in the GMF as replacements for those entered under LISTED DATA. Enter the data in the same manner as prescribed in Section 9.8.

(c) If the data are to be deleted from the field being modified, enter the field code and leave the data field blank.

b. All other data fields listed in Section 9.10 may be used at the option of the applicant.

(1) Agency Action Number (ACN) (10 Characters--1 Occurrence) The format of the entry shall consist of alpha and or numeric characters and represent agencies internal tracking information for agenda records. The field will be blank if not used by the agency for internal tracking.

(2) Supplementary Details (SUP) (72 Characters--15 Occurrences)

Agencies will review the SUPPLEMENTARY DETAILS for each assignment being modified to ensure that the data are correct and current. Comments relating to routine modifications (change of bureau, Net, equipment, etc.) are not required and must be removed from the record. Agencies shall not reiterate the modification action in SUP.

---

<sup>4</sup> A change to XAP or RAP in the bands 7125-8500 and 14500/15350 MHz for fixed systems would not apply to this non-interference change.

<sup>5</sup> If movement is less than 8 kilometers.

<sup>6</sup> A change to \*NTS would not apply to M002, M008, or M009 since these give protection to existing agencies and removal could cause serious interference issues.

<sup>7</sup> A change to SUP in the AAG bands and 162/174 MHz would not apply to this non-interference change.

However, enter comments if the modification is to an assignment that must be RE-COORDINATED with Canada. Insert (CANCOR REFERENCE US SERIAL XXXXX followed by information to rationalize the re-coordination).

*Example:* SUP01 (CANCOR REFERENCE US SERIAL I8031849. INCREASE POWER.)

## **9.12 PREPARATION OF THE CARD FORMAT FOR A RENEWAL ACTION**

1. Before submitting a RENEWAL action, read Section 9.7.1 and Section 9.9.
2. The following card formatting rules apply:
  - a. Each RENEWAL action requires:
    - (1) The COMMAND CARD:  
\$\$CHG (Enter the serial number of the assignment being renewed as it is recorded in the GMF)
    - (2) The TYPE OF ACTION (TYP) Card: TYP01 R
    - (3) The DATE (DAT) Card:

DAT01 (Enter the date (year/month/day) on which the application is prepared. Use numeric characters only; leave no blanks.)

- (4) the DATA CARD EXD: EXD01 880615

For the renewal of temporary assignments, the new date is not to exceed five years hence.

- (5) Updates to other particulars of the assignment, (e.g., REM06 \*SYS, SURVEY)

b. The ROUTINE (RTN) data field may not be used for renewal applications unless the assignment contains at least one of the following Notes: L192, L197, L199, S035, S160, S279, or S348.

## **9.13 PREPARATION OF THE CARD FORMAT FOR A DELETION ACTION**

1. Before submitting a DELETION action, read Section 9.7.1 and Section 9.9.
2. The following card formatting rules apply:
  - a. Each DELETION action requires:
    - (1) The COMMAND CARD:  
\$\$CHG (Enter the serial number of the assignment being deleted as it is recorded in the GMF)
    - (2) The TYPE OF ACTION (TYP) Card: TYP01 D
    - (3) The DATE (DAT) Card:

DAT01 (Enter the date (year/month/ day) on which the application is prepared. Use numeric characters only; leave no blanks)

- b. Agency Action Number (ACN) may be submitted on a DELETION action.

## **9.14 APPLICATIONS CONSIDERED BY THE AERONAUTICAL ADVISORY GROUP (AAG) AND THE MILITARY ADVISORY GROUP (MAG)**

### **9.14.1 Applications Considered by AAG**

1. The AAG is responsible for engineering AAG frequency assignments and determining whether or not applications for frequency assignment action in the following bands should be submitted to NTIA for approval.

190-285 kHz  
285-435 kHz\*  
510-535 kHz\*  
74.800-75.200 MHz  
108.000-121.9375 MHz  
123.5875-128.8125 MHz  
132.0125-136.000 MHz  
328.600-335.400 MHz  
978-1020 MHz inclusive  
1030 MHz

1031-1087 MHz inclusive  
1090 MHz  
1104-1146 MHz inclusive  
1157-1213 MHz inclusive  
5000-5250 MHz

\* In these bands only applications for stations in the Aeronautical Radionavigation Service (see Table A, Section 6.1.4) shall be sent to the Chairman of the AAG.

2. For frequency assignment proposals in the above bands, agencies shall transmit UNCLASSIFIED applications to NTIA viaprocesses identified in Section 9.3.1. Send non-federal applications directly to the Chairman, AAG, or directly to NTIA at the option of the FCC FAS Representative; additionally, the requestor's point of contact must be included on the application.

3. Exceptionally, the following types of applications for assignment in the above bands shall be prepared and processed in accordance with the provisions of Sections 9.3 through 9.13.

- a. Those which are classified,
- b. Those which must be referred to the IRAC (see Section 10.9),
- c. Those for space radiocommunication, and
- d. Those known to be controversial.

4. Submit unclassified frequency assignment proposals in the bands above for engineering analysis and review by FAA via WebFCR. Add Coordination Note C089 to the Notes Field (NTS) on each non-FAA proposal. (See Annex A and Annex D). Additionally, the applicant may indicate the date of coordination and the FAA point of contact, and correspondence identification, if applicable, in the FAS data field.

5. After technical evaluation, coordination, and other appropriate action, the Chairman of the AAG as well as other AAG members shall vote their decision via the Automated Voting Procedures, Section 9.16.2.

5. After technical evaluation, coordination, and other appropriate action, the Chairman of the AAG as well as other AAG members shall vote their decision via the Automated Voting Procedures, Section 9.16.2.

#### **9.14.2 Applications Considered by MAG**

1. The MAG is responsible for determining whether or not applications for frequency assignment action in the bands 225.0-328.6 and 335.4-399.9 MHz should be submitted to NTIA for approval.

2. For assignment actions involving these bands, agencies will transmit UNCLASSIFIED applications to NTIA viaprocesses identified in Section 9.3.1.

3. Exceptionally, the following types of applications shall be prepared and processed in accordance with the provisions of Sections 9.3 through 9.13:

- a. Those which are classified SECRET,
- b. Those which must be referred to the IRAC,
- c. Those involving transmissions to or from space, and
- d. Those known to be controversial.

4. After technical evaluation, coordination (if necessary), and other appropriate action, the Chairman of the MAG as well as other MAG members shall vote their decision via the Automated Voting Procedures, Section 9.16.2.

#### **9.15 OTHER GMF FIELD CODES**

The following field codes are presented for information. Only the field code RYR is addressable in a frequency assignment action (see Sections 9.10 and 9.11 and Annex F.)

- a. *AUD--AUTHORIZATION DATE (6 Characters-1 Occurrence)*

The date on which the assignment was originally authorized. The format used in YYMMDD.

- b. *AUS--AUTHORIZATION NUMBER (8 Characters)--10 Occurrences)*

(1) This unique number is generated internally by the agenda preparation programs each time an action on a frequency assignment appears on the FAS agenda. This is the FAS docket

(DKT) number of the action on the FAS agenda.

(2) Up to ten entries (occurrences) are retained in the assignment record in the GMF. The first entry will always be the most current authorization number. If there is more than one entry, the *ORIGINAL* authorization number will always be retained as the second entry. When the AUS field becomes full (10 occurrences), more room is created by dropping the older, *NON-ORIGINAL*, entries and moving all others down.

c. *MBR--AGENCY MEMBERSHIP (1 Character--1 Occurrence)*

This field designates agency membership in the Frequency Assignment Subcommittee (FAS) community.

M Voting Member of the FAS

N Non-Voting/Non-Member of the FAS. NTIA represents these agencies in the FAS.

O Non-Voting/Non-Member of the FAS. Other FAS Member agencies represent these agencies in the FAS.

X Non-Voting/Non-Member of the FAS. Canadian and Mexican records in the GMF are currently identified by the letter X.

d. *RVD--REVISION DATE (6 Characters-1 Occurrence)*

The date on which the frequency assignment was most recently revised. The format used is YYMMDD.

e. *RYR--REVIEW YEAR (2 Characters--1 Occurrence)*

This field is used **ONLY** when no other changes are required (all parameters as listed are up-to-date) and it is necessary to indicate a review of an assignment has been completed (see Annex F). (If any change is being submitted to any character of any data field, the RYR need not be submitted.) The RYR field is not retained in the assignment record-it resets the date in the RVD field, which is retained in the GMF.

## 9.16 FAS AGENDA ACTIONS

### 9.16.1 FAS Votes and Agenda Corrections Directives

1. Directives are changes to a field(s) of a frequency application proposal on the FAS agenda. Directives shall be transmitted to the NTIA/SSD Automated Data Capture System via the telephone dial-up electronic data transfer method.

2. FAS agenda DIRECTIVES shall be prepared in card format, and the following rules apply:

a. A \$\$DIR COMMAND CARD and an AGC01 card are both required for each DIRECTIVE package.

(1) If the DIRECTIVE(s) applies to a single application, or to multiple applications NOT in numerical sequence by Docket Number (DKT), the Command Entry must be on the first line. Enter \$\$DIR, a space, then the docket number (DKT) of the application being addressed.

(2) If an identical DIRECTIVE(s) applies to a series of applications in numerical sequence by docket number, on the first line enter ENDREQ RANGE, a space, the FIRST docket number of the sequence, a slant bar, then the LAST docket number of the sequence. On the second line enter \$\$DIR, a space, then the FIRST docket number of the sequence.

(3) Enter the AGC01 card into the DIRECTIVE package at any place following the \$\$DIR card. Enter AGC01, a space, then the agency abbreviation of the agency submitting the DIRECTIVE package (see Annex G, Section G.1).

b. DATA ENTRIES will follow the procedures specified in Section 9.7.2, paragraph 3b and as outlined in paragraphs 3 and 4 below.

c. Comments concerning an FAS agenda docket which the applicant or the NTIA/SSD wishes to make a part of the FAS agenda record, but not a part of the GMF record, may be entered using the field mnemonic FAS (see Section 9.8.2, paragraph 79).

3. Changes to applications on the FAS agenda may be made by submission of DIRECTIVES. However, no more than 99 data fields may be changed and the following rules apply:

a. Serial Numbers (SER) may never be changed.

b. The FREQUENCY (FRQ) field may not be changed on applications undergoing Canadian coordination. To change FRQ a new application must be submitted. (A new agency serial number is required unless the original application is withdrawn first.)

c. If the application is a MODIFICATION or RENEWAL no change may be made to the FREQUENCY (FRQ) and TRANSMITTER STATE/COUNTRY (XSC) fields.

d. If the application is a DELETION, no changes are allowed.

e. Changes to any field not listed in 3f, below, will result in the application being redistributed to the FAS

representatives for additional review. All agencies, except the host, must vote on the redistributed application. A redistributed application previously TABLED by an agency other than the host will REMAIN TABLED until the tabling agency votes to accept (see paragraph 4, below).

f. The following fields may be changed without causing redistribution or rejection:

(1) ACL, ACN, BUR, \*DFI, ICI, \*IFI, \*MFI, \*PRD, NET, RAL, RAP, RAZ, RRC, RYR, SPD, SUP, XCL, XRC, VOT, \*AGN, \*CAN, \*DOC, \*EQT, \*EQR, \*EQS, \*EBW, \*SBW, \*EGN, \*SGN, \*ENT, \*RNT, \*SNT, \*JNT, \*MEX, \*ORB, \*RPT, \*USA.

(2) \*ESB, \*ESR, \*EST--ONLY if added as a new occurrence.

(3) EXD--ONLY if changed from blank to numeric, or if the change decreases numeric value in the application.

(4) NTS--ONLY if added as a new occurrence and does not include a new entry of S148, S164, S288 or S322.

(5) XAL--However, if the FAS agenda item is a MODIFICATION action and the XAL was changed on initial submission, it may NOT be changed back to the ORIGINAL XAL via a directive. (If the agency desires to do this, the MODIFICATION or RENEWAL action must be withdrawn from the agenda and resubmitted at a later date with the correct XAL.)

(6) FAS--However, if changes are necessary, resubmit the entire FAS field with the changes incorporated.

4. VOTE DIRECTIVES shall be submitted using the mnemonic VOT with any two digit occurrence number, however 00 (zero zero) is recommended. A VOTE is a four part field - THE FIRST THREE MUST ALWAYS BE COMPLETED.

a. The first part consists of a single letter followed by a comma. Use:

(1) the letter A to accept the application;

(2) the letter T to table the application;

(3) the letter R to withdraw the application (only the submitting (host) agency or NTIA may vote R);

b. The second part consists of the abbreviation (see Annex G) of the FAS member agency submitting the VOTE DIRECTIVE followed by a comma.

c. The third part shall always be the five (5) digit number found in RVS for the application being voted upon. To ensure that votes are applied to the most current version of an application, votes that do not match the number found in RVS by NTIA's automated program will not be processed and registered.

d. IF PART FOUR IS USED, a COMMA must be included immediately AFTER THE SECTION NUMBER in part three. The fourth part is a 59 character field for agencies to use for comments concerning the application. As a minimum, agencies tabling an application shall include comments with reason for tabling, or provide a name and telephone number for further contact.

*Examples:*

\$\$DIR I8900006  
AGC01 NTIA  
VOT00 T,NTIA,00025,CONTACT JOHN SMITH,PH 202-202-2020

ENDREQ RANGE I8900290/I8900310  
\$\$DIR I8900290  
AGC01 USGM  
VOT00 A, USGM,00315  
\$\$DIR I8900330  
AGC01 USGM  
VOT00 R, USGM,00315,TO RESUBMIT

\$\$DIR I8900331  
AGC01 USGM  
REM02 \*AGN,NEW INFO  
REM03 \*EQS,LMS

### 9.16.2 Agency Comments and Voting Procedures

1. CONDITIONAL comments, called Minute Notes, may be recorded on frequency assignment actions (see Section 9.8.2, Paragraph 39). These comments will not duplicate conditions specified in a Record Note (see Annex A) or a Footnote to the Table of Frequency Allocations (see Section 4.1), and will be submitted in card format as a DIRECTIVE in accordance with Section 9.16.1 and below.

a. Directives adding Minute Notes to an assignment action must be submitted only by the host agency. An agency wishing to record Minute Notes on another agency's application must submit a VOTE DIRECTIVE to table the application, and include comments as to the reason for the tabling action. Agencies may only vote to table another agency's application if harmful interference is anticipated, there are technical errors in the application that affect the electromagnetic environment or the request violates NTIA radio spectrum policy. If an agency tables an application due to a violation of NTIA radio spectrum policy, the tabling agency must cite the specific policy violated (not to include Chapters 6 or 9). The Frequency Assignment Branch (FAB) shall review the policy issue and report its decision to the FAS. Agencies are encouraged to communicate their concerns and attempt resolution prior to tabling an application, particularly where similar tabling actions may apply to many applications. Furthermore, agencies are encouraged to remove their tabling action promptly once the application has been corrected or the issue resolved.

b. Minute Notes that will exceed eight lines of the CIRCUIT REMARKS field must be submitted by letter to the Secretary, FAS. The FAS Secretary will assign an FAS Administrative (ADM) Docket number to the comments. The FAS ADM Docket number will then be recorded in the Circuit Remarks field of the affected application by the NTIA/SSD.

2. Frequency assignment actions on the FAS agenda will not normally be approved by NTIA until all voting is unanimous, or 9 workdays after the Initial Processing Date (IPD) for NEW proposals and MODIFICATIONS, 5 workdays after the IPD for routine MODIFICATIONS, and 1 workday after the IPD for DELETES. The exceptions for AAG, and Canada, are listed in 2c below. All voting shall be in accordance with the following:

a. FAS member agencies MAY vote either to accept (A) or table (T) another agency's applications, and MAY vote to withdraw (R) their own applications. However, an agency MAY NOT vote to withdraw (R) another agency's applications.

b. FAS members that represent other agencies are considered the host and need not vote on the applications they submit on behalf of the represented agency, except to vote a withdrawal (R).

c. Applications, except those within the AAG area of responsibility or those from Canada and Mexico, will be automatically approved by NTIA 9 workdays after the IPD for NEW proposals and MODIFICATIONS, 5 workdays after the IPD for routine MODIFICATIONS, 1 workday after the IPD for DELETES, and 5 working days after the IPD for agency NGR (for the bands 71-76 and 81-86 GHz) if NTIA votes accept, unless a vote to TABLE has been recorded.

(1) Applications within the AAG area of responsibility, which have not been voted to ACCEPT by the Chairman of the AAG within 9 workdays of the IPD will be automatically TABLED to the AAG Chairman.

(2) Applications from Canada and Mexico will be automatically approved by NTIA after 30 calendar days of the IPD unless a vote to TABLE has been recorded.

### 9.16.3 Agency Votes and Directives on Canadian and Mexican Frequency Assignment Proposals

1. Agency votes and directives on Canadian and Mexican frequency assignment proposals on the FAS agenda will be prepared in accordance with 9.16.1. NTIA's vote represents a vote on behalf of the non-member agencies.

2. Agencies may only vote A to ACCEPT, or T to TABLE. Agencies may not make directive changes to Canadian or Mexican proposals except to add a \*USA entry to the Circuit Remarks (REM) field or revise their own \*USA comment.

3. Only Canada or Mexico may vote R to REJECT/WITHDRAW their own proposals. NTIA may vote to REJECT a Canadian or Mexican proposal which is TABLED with an HIA comment, but only after some mutually agreed upon period of time with no resolution of the problem indicated by the HIA comment.

4. Vote A if the proposal is No Harmful Interference Anticipated - NHIA

\$\$DIR I9102222

AGC01 NASA

VOT00 A,NASA,00690,NHIA



5. If the proposal is NHIA but adding some additional information or make a noting comment, vote A and use the acronym NHIC in the comment (VCM) portion of the vote card. Follow the vote card with an entry for the Circuit Remarks field (REM) using the identifier \*USA for the comment. If the vote is NHIC and there is no \*USA entry for Circuit Remarks, the reply will go to Canada or Mexico as NHIA. An agency card is mandatory in order to connect the appropriate agency with the associated remarks.

\$\$DIR I9102223  
AGC01 J  
VOT00 A,J ,00690,NHIC  
REM05 \*USA,NHIC, Noting use of M163.4375,U.S.  
REM06 \*USA,NHIC,serial I8701234, Detroit, MI.

6. Vote T for Harmful Interference Anticipated -HIA. Use HIA in the VCM portion of the vote card. Follow the vote card with an entry for REM using the identifier \*USA for the comment. An agency card is mandatory.

\$\$DIR I9102224  
AGC01 AR  
VOT00 T,AR ,00690,HIA  
REM03 \*USA,HIA,U.S. serial I8302345, M169.25,  
REM04 \*USA,HIA,Detroit, MI.

#### **9.16.4 Coordination and Referral of Applications for Frequency Assignment Action**

1. In accordance with the agreement shown in Section 3.4, the NTIA's Spectrum Services Division (SSD) coordinates certain applications for frequency assignment action with the Canadian Department of Industry (Industry Canada). When it is determined that an application must be coordinated with Canada, the NTIA/SSD will table the application pending comments from Canada concerning the coordination.

2. By applying for a frequency assignment an agency coordinates with other agencies which might be affected by the applicant's use of the frequency through the FAS agenda process. In the event that unfavorable coordination comments are received either before or subsequent to submission of an application for the FAS agenda, applicants may request the application be referred to a meeting of the FAS for deliberation.

a. To request referral, the host shall include a request for referral using the VOTE directive; the host shall vote to table and shall use only the words REFER TO FAS in the comments portion of the Vote directive (see 9.16.1 above).

b. If referral is requested, the host should also submit a letter to the FAS Secretary with a copy of all unfavorable comments attached, explaining in detail why the application should be favorably considered. The FAS will deliberate the applications and recommend a course of action.

3. An item on the FAS agenda shall be referred to the IRAC for consideration:

- a. Upon the specific request of any FAS member agency or the FAS Chairman;
- b. If it cannot be resolved solely on the basis of technical considerations;
- c. If it is a matter for which policy has not heretofore been established;
- d. At the specific request of the IRAC; or,
- e. If specifically directed by other sections of this Manual.

4. The FAS shall take no action on an item referred to the IRAC until advice has been received from the IRAC. When referring items to the IRAC, the FAS should provide all pertinent information, including:

- a. A statement of the problem;
- b. Facts bearing on the problem, including the background;
- c. A list of agencies that favored approval and those that favored disapproval; and,
- d. A brief statement of the basis given by those agencies that objected to approval of the item.

**(Last Page in Chapter 9)**

## **Chapter 10**

# **Procedures for the Review of Telecommunication Systems for Certification of Spectrum Support**

## **10.1 GENERAL**

### **10.1.1 Avoiding Interference**

Federal agencies planning the use of, conducting experiments relating to, or developing and procuring telecommunication systems requiring the use of radio frequencies must take all reasonable measures to ensure that such systems will neither cause harmful interference to nor receive harmful interference from other authorized users when placed in their intended operational environments. In planning telecommunication systems within the scope of this procedure, federal agencies must develop systems for operational use in accordance with the applicable portions of the National Table of Frequency Allocations and the provisions of this Manual unless an exception is recommended by the Spectrum Planning Subcommittee (SPS) and approved by NTIA.

### **10.1.2 Satisfying Office of Management and Budget Circular A-11**

Office of Management and Budget (OMB) Circular No. A-11 specifies in Section 31.12 “You must obtain a certification by the National Telecommunications and Information Administration (NTIA) of the Department of Commerce, or your agency as designated by NTIA, that the radio frequencies required can be made available before you submit estimates for the development or procurement of major radio spectrum-dependent communications-electronics systems (including all systems employing space satellite techniques). The NTIA, which is responsible for assigning spectrum to Federal users, may also review these [economic] analyses [of alternative systems/solutions], during the assignment process.” NTIA certification of spectrum support can be obtained using the procedures in this chapter. The matter of preparation and submission to OMB of budget estimates for federal systems is covered in Section 8.2.5.

### **10.1.3 SPS Review of New Systems**

To assist federal agencies in meeting the above responsibilities and to support the NTIA and the IRAC in the management of radio spectrum resources for the satisfaction of federal requirements, and in the national interest, these procedures provide for the review of certain new federal telecommunication systems and subsystems by the SPS, at a number of the stages of their evolution, prior to the assignment of frequencies. Such review will, as appropriate, require an examination of the existing systems in the frequency band(s) being considered.

### **10.1.4 FCC Participation**

Full participation of the FCC in these procedures, for the review of federal systems intended for operation in bands of mutual federal/non-federal interest, occurs through the normal FCC liaison representation on the IRAC and its subcommittees.

## **10.2 DEFINITIONS**

### **10.2.1 Telecommunication System**

A telecommunication system, for the purpose of this review procedure, is a combination of facilities, stations, or circuits intended to perform an information transfer function by the use of the radio spectrum, for example:

- a. A space station and its associated earth stations for provision of meteorological information;
- b. A combination of aeronautical stations for communication support of air traffic control;
- c. An interconnected network of fixed stations;
- d. A combination of fixed and land mobile stations intended to provide communication support for law enforcement or protection activities on a local or area-wide basis;

- e. A combination of facilities intended to provide a radionavigation service; or
- f. A combination of facilities intended to provide a radiolocation (radar) service.

### **10.2.2 Telecommunication Subsystem**

A telecommunication subsystem, for the purpose of this review procedure, is a combination of facilities, stations, or circuits intended to provide telecommunication support to a broader functional telecommunication entity (e.g., the surveillance portion of an air defense system or an avionics package of a nomenclatures aircraft).

### **10.2.3 Major System or Subsystem**

A major system or subsystem is a telecommunication system or subsystem, including satellites or spacecraft, which may have significant impact on existing or potential future use of the portion of the radio frequency spectrum in which it is intended to operate, taking into account systems of the same radio service and those of any other radio service with which the spectrum in question is shared.

### **10.2.4 Major Modification**

A major modification is any change of the technical or operational characteristics of an existing telecommunication system or subsystem which may have significant impact on existing or potential future use of the portion of the radio frequency spectrum in which it is intended to operate, taking into account systems of the same radio service and those of other radio services with which the spectrum in question is shared.

### **10.2.5 System Review**

The system review is a procedure used by the SPS to develop recommendations on behalf of the IRAC for the Deputy Associate Administrator, Office of Spectrum Management of NTIA, regarding certification of spectrum support for telecommunication systems or subsystems coming within the scope of this chapter.

### **10.2.6 Notification of Transportable AWS, Cell, and PCS Systems in Selected Bands**

Agencies planning to procure transportable Advanced Wireless Service (AWS), Cellular, and Personal Communications Services (PCS) Systems, including Cell-On-Wheels (COW) and Cell-On-Light Truck (Colt) systems, which operate in the bands 698-758, 775-788, 805-806, 824-849 MHz, 901-902 MHz, 930-931 MHz, 940-941 MHz, 1710-1755 MHz, 1850-1990 MHz, and 2110-2155 MHz are required to obtain certification of spectrum support from NTIA,. Requests for spectrum certification of such systems must be submitted for review by the SPS and must contain the following information:

- a. Stage of Review: Indicate the stage of review requested.
- b. Responsible Organization Entity and Point-of-Contact: Provide the name of the bureau, program office, or other organization entity responsible for the field-level deployment and management of the system, including a telephone point-of-contact.
- c. Equipment Identification: Name of the manufacturer of the equipment and the name or model number of the specific equipment.
- d. FCC Certification Identification Number(s): Provide the FCC ID Number(s) of all transmitters in the system.
- e. Number of Units: Number of individually deployable transportable units that will be operating cooperatively and simultaneously within the deployed system.
- f. Frequency Band(s): Identify the frequency band(s) in which the subject system is to operate.
- g. Power: Transmitter power in watts of each unit in the deployable system.
- h. Emission Designator(s): Specify the emission designator(s) for transmitters within the system.
- i. Rationale for the Procurement of the System: Submit justification for procurement of the system and an explanation of the plans and conditions under which the system would be deployed, including projected arrangements or constraints related to sharing of the system among other federal agencies.
- j. Federal agency agreement with non-federal entity: Provide a summation of agreements established to facilitate the operation of the system.

## **10.3 SCOPE OF REVIEW PROCEDURE**

### **10.3.1 Applicability and Limitations**

This review procedure is applicable to experimental projects and systems as defined in Section 10.2 and is limited to:

- a. New telecommunication systems or subsystems, and major modifications to existing systems or subsystems, involving the use of satellites or spacecraft;
- b. New major terrestrial systems or subsystems, and major modifications to existing systems or subsystems;
- c. Such systems or facilities as may be referred to the SPS on a case-by-case basis by the NTIA, the IRAC, the FAS, or a cognizant federal agency. Such referral may result from factors of system cost or importance, or follow from estimates of unusual potential impact on other spectrum uses.

### **10.3.2 Exemption from Spectrum Certification**

### **10.3.3 Electronic Warfare/Electronic Counter-Measures (EW/ECM) Threat Simulators**

EW/ECM threat simulators are specialized RF systems which operate in many parts of the frequency spectrum. These systems are used for testing, training, and evaluation of electronic warfare systems and procedures. They usually operate at military installations and ranges as specified in Sections 7.11 and 7.17. Threat simulators operate in accordance with Section 7.14, but their frequency assignments are exempt from the provisions of Chapter 10. This does not preclude the review of EW/ECM threat simulators by the IRAC. All threat simulator assignments will use the 'XT' station class and bear the special note 371.

### **10.3.4 Non-Licensed Devices**

Federal policy for non-licensed devices is covered in Section 7.8, and such devices will normally not be considered for the purpose of this review procedure. Plans or proposals to operate non-licensed devices in space, however, must be submitted to the SPS for the record (this information should be submitted via a short memorandum and include the frequency bands, Part 15 FCC ID number if applicable, and how the equipment will be used). Agencies can request that information on a non-licensed device, regardless of whether it is to be used in a terrestrial application or in space, must include a justification for SPS consideration of such a device.

### **10.3.5 Individual Stations, Links, or Networks**

An individual radio station, an individual point-to-point radio link, or an individual network in the mobile radio service, any of which is to become a part of an existing identified telecommunication system or subsystem, for example, will normally not be considered for the purpose of this review procedure. Applications and plans for such individual stations, radio links, and services will be reviewed by the SPS only upon direct referral for cogent reasons such as given in Subsection 10.3.1.c.

### **10.3.6 Individual Components**

An individual component of a system or subsystem, as defined in Section 10.2, normally will not be considered for the purpose of this review procedure.

### **10.3.7 Federal Use of the Band 220-222 MHz**

Nationwide systems using the two designated, exclusive federal nationwide 5-channel blocks and local systems operating on the channels shared with non-federal users in the band 220-222 MHz are included in this review procedure. Detailed equipment characteristics of systems that have been type-accepted by the FCC or already received by the SPS will normally not be considered for the purpose of this review procedure. However, a list of all base stations (geographic coordinates when known and site names), with antenna heights, effective radiated power, and dates of construction and bringing into use for each nationwide and non-nationwide system must be provided to the SPS for review. Justification of any implementation dates more than 1 year after the requested date of Stage 4

Certification of Spectrum Support should be included for non-nationwide systems.

### **10.3.8 Spectrum Support for Use of Federal Ultrawideband Systems Not Intended for Operation under Section 7.8**

Federal agencies desiring to deploy UWB systems that do not conform to Section 7.8 shall request spectrum support in accordance with Section 10-10.

## **10.4 STAGES OF REVIEW AND SCHEDULING**

### **10.4.1 Stages of Review**

a. Stage 1, Conceptual: Certification of spectrum support at Stage 1 provides guidance as to the feasibility of obtaining certification of spectrum support for the proposed system at subsequent stages of review. For this stage of review, the minimum data requirement includes the proposed frequency band(s), each station classified by the service in which it operates, and a general description of the proposed system. The guidance provided will provide recommendations such as: alternative frequency bands, necessary to assure conformance with the National Table of Frequency Allocations, alternative service and/or station classes, and other general guidance to help the proposed system meet any other applicable regulation.

b. Stage 2, Experimental: Certification of spectrum support at Stage 2 is a prerequisite for NTIA authorization of radiation (with a temporary frequency assignment) in support of experimentation for systems that radiate into the environment and are subject to these procedures. Certification at Stage 2 may be requested for new technological concepts, modified operational equipment, or initial design models that can be used to determine which of several frequency bands or which of several proposed equipment configurations should be selected for continued investigation. The guidance provided at this stage will indicate required changes and any additional information necessary to assure certification of spectrum support at subsequent stages.

c. Stage 3, Developmental: Certification of spectrum support at Stage 3 is a prerequisite for NTIA authorization of radiation in support of developmental testing for systems that radiate into the environment and are subject to these procedures. At this point, the intended frequency band will normally have been determined and all data requirements can be provided (or the rationale for missing information explained). Certification at Stage 3 will be required for testing of proposed operational hardware and potential equipment configurations to assess potential electromagnetic compatibility (EMC). The major design has been completed, and radiation may be required during testing; and

d. Stage 4, Operational: Certification of spectrum support at Stage 4 is a prerequisite for NTIA authorization of radiation with a regular frequency assignment for systems that radiate into the environment and are subject to these procedures. Stage 4 certification provides restrictions on the operation of the system or subsystem as may be necessary to prevent harmful interference.

### **10.4.2 Scheduling of Reviews**

Systems or subsystems falling within the scope of this chapter must be referred to the SPS in sufficient time to permit guidance to be developed by SPS and NTIA and applied by the agency. Routine system reviews can be typically completed and spectrum support guidance can be provided within two to six months from the date of submission to SPS. The submitter must consider this time period and the provision of Subsection 10.5.3.1 requiring the FAS to withhold frequency assignments until the assignment particulars conform to the spectrum support guidance. For space systems, the submitter must also consider the time requirements for international processing of advance publication, coordination, notification, and agreement documents.

## **10.5 RESPONSIBILITIES REGARDING CERTIFICATION OF SPECTRUM SUPPORT**

### **10.5.1 Spectrum Planning Subcommittee**

In its system reviews, the SPS must give consideration to:

1. System compliance with prevailing spectrum management policy, allocations, regulations, and technical standards (Federal, National, and International);

- a. The predicted degree of EMC between the proposed system and the electromagnetic environment; and,
  - b. The possible need for and evaluation of the results of prototype EMC testing.
2. Upon assessment of a proposed system or subsystem, considering these criteria and any other pertinent factors, the SPS will make recommendations with supporting documentation to NTIA, for:
  - a. Approval of spectrum support for the system at its proposed stage of development, without qualification; or
  - b. Approval of spectrum support subject to stated limitations or to modification of the proposed system; or
  - c. approval of spectrum support subject to limitations or modifications to systems already in the band; or
  - d. Approval of spectrum support subject to submission of information for advance publication, agreement of affected foreign administrations, notices for coordination, and notification of frequency assignments for unclassified space systems, as appropriate, under the provisions of Articles 5, 9 and 11 of the ITU Radio Regulations; or
  - e. Disapproval of spectrum support.
3. The SPS will refer cases when the affected agencies are unable to reconcile specific points of potential EMC conflict to the IRAC for resolution.

### **10.5.2 Space Systems Subcommittee**

The SSS must review the data furnished by federal agencies at Stages 2 and/or 3 of the certification process regarding the advance publication, agreement with affected administrations, and coordination and notification of frequency assignments for space telecommunication systems under the provisions of Articles **5**, **9** and **11** of the ITU Radio Regulations. The SSS must give consideration to:

1. The conformance of the system to the provisions of the ITU Radio Regulations and applicable Radiocommunication Bureau (BR) Circular Letters;
2. The identification of those countries from whom agreement must be obtained under the provisions of the ITU Radio Regulations; and
3. The identification of those countries with whom the system must be coordinated under the provisions of the ITU Radio Regulations.

### **10.5.3 Frequency Assignment Subcommittee**

1. The FAS must not recommend the assignment of frequencies to stations in systems that are subject to these procedures until notice is received that frequency support for the system has been certified. The particulars of the assignments must conform to the terms of the certification of spectrum support. Assignment applications for such stations received in the FAS prior to system review must be tabled until the appropriate stage of the system review procedure has been completed. The FAS must inform the SPS of this action.

2. The FAS may recommend frequency assignment action for (a) additional stations and (b) the modification of assignments to stations in existing systems or systems approved under this procedure, provided the operations resulting from the assignment action will have only minor local effect upon the electromagnetic environment.

3. The FAS must place emphasis on the careful review of applications involving sharing of the same frequency bands by terrestrial and space services. When necessary, the FAS may recommend to IRAC that further EMC analysis by NTIA, or other cognizant agency, be completed prior to assignment action. Any matters that cannot be resolved, and those applications for which approval could result in major effects on the future use of the frequency band concerned, must be referred to the IRAC.

### **10.5.4 Technical Subcommittee**

The SPS will recommend changes to spectrum standards to the TSC. The TSC and its working groups must provide information from the ongoing programs in standards, criteria for spectrum sharing, propagation, trade-offs among telecommunication techniques, radio noise and interference environments, side effects of spectrum use, and federal-wide EMC capability. In addition, the TSC must be guided in its work, scope, and priority by requirements

identified by the IRAC for support of EMC reviews underway and expected in accordance with these procedures. The TSC will inform the SPS of changes to spectrum standards.

### **10.5.5 Emergency Planning Subcommittee**

The SPS will refer certifications with an NSEP function to the EPS.

### **10.5.6 Federal Agencies**

1. Agencies will participate in the application of these procedures in the SPS and shall provide information needed for the system review as specified in Sections 10.7 and 10.8.

2. SPS representatives are responsible for determining within their agencies which systems come within the scope of this procedure (see Section 10.3) and should, therefore, be submitted to the SPS for system reviews and possible certifications of spectrum support. In making this determination, SPS representatives should give serious consideration to the spectrum-related concerns of other member agencies. A system review under Chapter 10 entails consideration of a more detailed EMC analysis than is appropriate within the frequency assignment process.

3. Agencies will take into account recommendations provided as a result of the system review in the modification and resubmission of proposals to improve system EMC characteristics and facilitate frequency support. Agencies may recommend and will consider modifications to existing facilities and will facilitate the accommodation of new systems. Agencies may participate in EMC studies specified in Section 10.6 as an active associate to the degree required to assure responsiveness to their requirements and responsibilities and will be consulted to assure development of realistic assignment criteria and other technical system considerations.

## **10.6 EMC ANALYSIS SUPPORT**

### **10.6.1 General**

1. In reviewing and assessing the EMC and frequency availability aspects of proposed telecommunication systems, as defined herein, the SPS must depend upon system and equipment characteristics data submitted by the proposing agency and upon available environmental information.

2. The SPS must make use of the results of any available technical studies and any pertinent EMC analysis capabilities within federal agencies when assessing proposed systems. More specifically, the SPS must arrange for and make use of existing EMC analysis capabilities and procedures of the DOD, NASA, and other federal agencies where they may expedite or enhance its assessment of a proposed system. Arrangement for such support will be obtained through NTIA. Moreover, the SPS must promote the cooperative exchange of views and information among the agencies that may provide EMC analysis support to the subcommittee. The SPS will be supported by NTIA and may refer to NTIA, as appropriate, system proposals for evaluation and recommendations regarding:

- a. compliance with prevailing spectrum standards and sharing criteria;
- b. predicted degree of EMC with the environment;
- c. relative efficiency in the use of the radio spectrum by the proposed system;
- d. system modification or alternatives, including modifications to stations already operating in the band(s) in question, where appropriate; and
- e. technical solutions for systems having conflicting spectrum requirements within the US&P.

3. The SSS will be supported by NTIA and may refer to NTIA, as appropriate, U.S. and foreign space system proposals for evaluation and recommendations regarding:

- a. conformance to applicable national and international rules and regulations;
- b. predicted degree of EMC with the environment; and
- c. system modifications or alternatives, including modifications to stations already operating in the band(s) in question, where appropriate.

### **10.6.2 Types of Analysis**

1. Types of analysis will vary from a determination of gross impact on the spectrum to detailed EMC analysis. The level and complexity of analysis must depend on the quality of the data available at the various stages of system



development.

2. In analyses leading to certification of spectrum support at Stage 1, Conceptual, much of the system data will be estimated, only gross calculations may be achievable for a general evaluation of spectrum impact that will be subject to adjustment during later stages. The system will be reviewed in conformance to International and National Allocation Tables. In addition, checks will be made against existing standards and sharing criteria, comparison will be made with known similar systems, and spectrum efficiency will be considered.

3. In analyses leading to certification of spectrum support at Stage 2, Experimental, the foregoing types of analysis will be applied where appropriate with more specific EMC analysis against a typical environment being added where experimental testing of technically defined equipment is involved. Recommendations for changes to equipment characteristics and contemplated operational employment/deployment will be provided, where appropriate. Calculations required in connection with national and international space coordination procedures in accordance with the methods of Appendices 7 and 8 of the ITU Radio Regulations will be performed to the extent practicable.

4. In analyses leading to certification of spectrum support at Stage 3, Developmental, more detailed EMC analyses will be performed, using measured data from experimentation when available. Appropriate recommendations as to equipment characteristics and/or operational employment/deployment will be developed. Calculations in connection with national and international space system coordination procedures will be performed or updated as appropriate.

5. In analyses leading to certification of spectrum support at Stage 4, Operational, detailed EMC analyses will be updated, as required, to include consideration of frequency assignments for specific system deployment. Appropriate recommendations as to equipment characteristics and/or operational limitations will be provided.

### **10.6.3 Prototype EMC Testing**

When the results of EMC analyses so indicate, prototype EMC tests may be required as an input to the determination of spectrum availability and electromagnetic compatibility.

## **10.7 GENERAL DATA REQUIREMENTS**

### **10.7.1 Minimum Data Required**

Federal agencies must provide data, as appropriate and categorized below, to the SPS for review at the various stages as systems mature, in accordance with the provisions of this chapter. All of the specified categories of data that are appropriate to the system under review are required for Stages 2, 3, and 4. While no specific minimums of data are specified for a Stage 1 review, beyond the guidance provided under the various categories below, agencies should provide sufficient data to allow determination of conformance with allocation tables and, for space systems, conformance with power flux density limitations.

### **10.7.2 Submission of Additional Data**

The SPS may request the submission of additional data or data estimates during the course of its system review, or may endorse direct contact between the EMC analysis support agency (NTIA or other) and the requesting agency for development of data estimates.

### **10.7.3 Updating of Data Previously Provided**

Agencies proposing new systems must be responsible for updating data provided to the SPS for the earlier stages, as more valid information becomes available and as the system progresses through the various review stages to its final operational configurations.

### **10.7.4 Changes to Submissions**

1. In between the time an agency submits a system to the SPS for review and prior to its NTIA approval, changes or additions to the system characteristics may occur. The requesting agency will submit changes or a replacement request in Equipment Location – Certification Information Database (EL-CID) format with a cover

letter explaining all of the changes from the previous submission. The purpose of this procedure is to ensure that the latest available data is included in the final NTIA system review package. All changes will be reviewed by the SPS before its recommendations to NTIA are finalized.

2. Changes or additions to an NTIA approved Certification of Spectrum Support may occur after a system has been certified. Changes submitted will include a revised EL-CID file and the Certification of Spectrum Support to be modified. The purpose of this procedure is to ensure that the members of the SPS may see the salient spectrum management issues in their present state, including those of a classified nature; and, this inclusion may permit the SPS provide a ruling at the table. All changes will be reviewed by the SPS before its recommendations to NTIA are finalized.

3. Changes or additions to an NTIA approved Certification of Spectrum Support that are of a potentially minor nature may be processed as addendums to the existing Certification of Spectrum Support. These changes include modification to radiocommunication nomenclature; addition of locations, antennas, emissions, or station classes; or administrative item changes. As long as these changes do not affect compliance with the NTIA Manual or increase potential interference, NTIA processes these types of requests for approval as any other new request. NTIA may be able to shorten the approval process of such requests considerably if such requests are of an administrative nature or the requested change does not affect the electromagnetic environment.

4. Any federal agency can make a request to change a currently approved certification as long as the nature of the change does not affect any conditions under which the certification was approved and that it does not exceed three addendums. If the number of addendums exceeds three, or there are conditions that may affect the current certification, it will require revisions to the current certification. To request a change, the agency will complete the Form NTIA-44 Addendum and submit it, along with the agency letter requesting the change and a copy of the latest NTIA certification of spectrum support (Form NTIA-44) to the SPS for review and processing by the proposed working group. For systems with existing EL-CID records, the agency will also include a new EL-CID record that shows the proposed changes to be made.

### 10.7.5 Selective Updating of Data

The SPS may request the selective updating of electromagnetic environmental data for specific areas and radio services, where necessary to support realistic EMC analyses of new systems.

## 10.8 SPECIFIC DATA REQUIREMENTS

1. Requests for Certification of Spectrum Support must contain information sufficient to enable the NTIA and the SPS to evaluate systems at its proposed stage of system development. The information necessary to support the system review process is summarized in Sections 10.8.1 through 10.8.8. Requests are to be prepared and submitted electronically in a format that is compatible with the Office of Spectrum Management Data Dictionary (OSMDD). NTIA has developed the Equipment Location – Certification Information Database (EL-CID) tool to facilitate preparation and submission of certification requests EL-CID is a suite of automated capabilities that provides a graphical, icon-based user interface that is supported by logic that captures relationships among and between groupings of data that characterize components of the system and modes in which the system operates. The tool facilitates entry of system parameters required to complete applications for certification of spectrum support. The EL-CID tool prompts users with displays and instructions for entering the specific data into a properly formatted file that can be used to conduct a system review. Help files are available through the EL-CID user interface to assist in clarifying data requirements and ensuring that it is formatted correctly.

2. The EL-CID tool is available to federal agencies and supporting contractors at: <http://www.ntia.doc.gov/osmhome/elcid>.

### 10.8.1 Information Required for all Systems

*System Name:* For commercial equipment, include the name of the manufacturer, a unique identifier, such as the model name and/or model number, and the type of system (e.g., fixed, land mobile, radar, earth station, etc.). For military equipment, include only one nomenclature and system type.

1. *Stage of Review Requested:* Indicate the stage of review requested.

2. *Purpose of the System:* Submit for all stages a summary description of the function of the system or subsystem (e.g., collect and disseminate meteorological data using satellite techniques; transmission of radar data

for air traffic control; remote control of ATC radars).

3. *Information Transfer Requirement*: Submit for all stages the required character, quantities, data rates, and circuit quality/reliability.

4. *Estimated Termination Date (where applicable)*.

5. *Estimated Initial Cost of the System*: Provide the estimated cost of the radiocommunication system, subsystem, or equipment for which certification is requested. If multiple units of the system are to be procured, the cost per unit and estimated number of units included in the procurement are to be specified. This item is for information to assist NTIA in monitoring the investment by federal agencies in spectrum-dependent systems and technology. It is not intended to be a determining factor in system reviews.

6. *Target Date*: Submit dates on which spectrum-related decisions must be made relative to system planning, development, procurement, and employment.

7. *System Relationship and Essentiality*: Submit for all stages a statement of the relationship between the proposed system and the function or operation it is intended to support. Include a brief statement of the essentiality to the supported function or operation.

8. *Replacement Information*: Identify the existing system(s) to be replaced by the proposed system, where applicable.

9. *Non-Conforming Operations*: Submit a justification for any telecommunication system or subsystem for which the proposed operations are not in accordance with the National Table of Frequency Allocations as directed in Section 10.1.1 of this Chapter. The justification should be accompanied by details of how it is feasible to conduct such non-conforming operations on a non-interference basis. This information is required for systems or subsystems that will operate in the U.S., its possessions, or in space in a manner that is not in complete conformance with the National Table of Frequency Allocations.

10. *National Security Emergency and Preparedness Function*: A statement as to whether the proposed system, if it becomes operational, will support a NSEP function and require review in accordance with Section 12.15.

## **10.8.2 Required Data for Space Systems**

1. Stage 1 and 2 Requirements:

a. Satellite orbital characteristics (longitude for geostationary satellites, and apogee, perigee, and inclination for non-geostationary satellites).

b. Satellite transmitter maximum spectral power density for each emission designator for each frequency or frequency band.

c. Earth station locations (city and state) within the US&P and earth station locations (city, country) outside US&P, and frequencies or frequency bands used at each.

2. Stage 3 Requirements – In addition to satisfying all Stage 1 and 2 requirements the following data items are required for each Earth station transmitter and receiver site:

a. Frequencies or frequency bands and satellites accessed.

b. Coordinates of earth stations.

c. Emission designator(s) for each frequency or frequency band.

d. Maximum spectral power density and output power for each emission designator for each frequency or frequency band.

e. Antenna gain and beamwidth.

f. Minimum elevation angle of antenna main beam.

g. Range of azimuth angles.

h. Lowest total receiver noise temperature.<sup>3</sup>

3. Stage 3 Requirements – In addition to satisfying all Stage 1 and 2 requirements for each space station transmitter and receiver:

a. Frequency or frequency bands and interoperating earth stations.

b. Satellite orbital information.

c. Emission designator(s) for each frequency or frequency band.

d. Peak power and spectral power density for each emissions designator for each frequency or frequency band for transmitters.

- e. Receiver noise temperature.
- f. Transmitter antenna pattern (only if PFD limits are exceeded).
- 4. Stage 4 Requirements; In addition to satisfying all Stage 3 requirements, the following data items are required for each earth station:
  - a. Horizon elevation angle diagram.
  - b. Antenna altitude above ground.
- 5. For unclassified space systems which have not been waived from the requirements of international registration as described in Section 3.3, similar information must be prepared in specific formats and submitted to the SSS in accordance with instructions in Section 3.3. The data required by the SSS to satisfy the specifications in Appendix 4 of the ITU Radio Regulations for:
  - a. Advance Publication must be submitted at the same time as the Stage 2 system review request;
  - b. Coordination and Notification data must be submitted at the same time as Stage 3 system review requests.
- 6. If any of the frequency bands proposed for the satellite network or system are subject to coordination under the ITU Radio Regulations, the simplified advance publication information for those bands, as set forth in Sub-Section IB of Article 9 of the Radio Regulations, cannot be used in lieu of 10.8.2 data. In those cases where the simplified advance publication information is required by the ITU, the simplified information as well as the 10.8.2 data must be submitted.

### **10.8.2.A Supplemental Information for Space Systems Using Necessary Bandwidths Greater Than 5 MHz for Transmissions from Space in the Band 2200-2290 MHz**

For space station transmitters that operate in the band 2200-2290 MHz and require use of necessary bandwidths that exceed 5 MHz, requests for certification must include a justification explaining why such bandwidth is required and why the need cannot be satisfied in another appropriate frequency band. Additionally, the sponsoring agency must explain why the radio communications requirement cannot be satisfied using less bandwidth. Spread spectrum missions (e.g., space-to-Tracking and Data Relay Satellite communications, lunar downlinks, and lunar data relay satellite communications) that enable multiple users on the same channel and require a necessary bandwidth of approximately 6.16 MHz, are exempt from this policy.

### **10.8.3 Required Data for Terrestrial Systems (All Stages)**

Required Data For Terrestrial Systems:

- a. Station class(es),
- b. Number of units (for mobile systems),
- c. Station locations and/or areas of operation, as appropriate (geographical coordinates required for Stages 2, 3, and 4),
- d. Frequency requirements (i.e., band(s) or discrete frequencies required, bandwidth and emission designators, and netting information, where appropriate),
- e. Proposed date of activation.

### **10.8.4 Related Analysis Data**

- 1. For all stages, submit reports of any previous EMC studies, predictions, analyses, and prototype EMC testing that are relevant to the assessment of the system under review, or references thereto if previously provided to the IRAC/SPS, including references to previous system reviews of the same system or its predecessors.
- 2. For military requests for Stage 3 spectrum certification of 1030/1090 MHz systems, attach a copy of the DOD International AIMS Program Office (PO) box-level certification letter, and for Stage 4 reviews, attach a copy of the DOD AIMS Program Office platform certification letter.

### **10.8.5 Describe Equipment Characteristics**

Technical characteristics of the system need to be provided to enable evaluation of compliance with applicable NTIA spectrum standards. Additionally, the equipment data needs to characterize operating modes by association of specific data elements on a mode-by-mode basis. The EL-CID tool has been designed to facilitate the collection

of the required information in a manner that associates data elements with specific operational modes.

### 10.8.6 Required Transmitter Characteristics Data

Required Transmitter Characteristics Data:

- a. The transmitter nomenclature/name model number and manufacturer.
- b. The frequency stability.
- c. The spurious emission level.
- d. The harmonic emission levels for the 2<sup>nd</sup> and 3<sup>rd</sup> harmonics.
- e. The transmitter power delivered to the antenna terminals.
- f. The frequency range through which the transmitter is capable of being tuned.
- g. The emission designators for the types of emission capable of being used by the transmitter.
- h. For each emission designator the emission bandwidth at the -3, -20, -40, and -60 dB levels.
- i. For each emission designator based on the modulation symbols and the description of the modulation methods the EL-CID tool will request the technical data required to describe the modulation.
- j. Identify the availability of an automatic transmit power control system for fixed microwave systems in the bands 1780-1850 MHz, 2200-2290 MHz, 4400-4940 MHz, and 7125-8500 MHz.

### 10.8.7 Required Receiver Characteristics Data

Receiver Characteristics Data:

- a. The receiver nomenclature/name model number and manufacturer.
- b. The spurious rejection level.
- c. The image rejection level.
- d. The frequency range through which the receiver is capable of being tuned.
- e. The emission designators identifying the types of emission for which this receiver is designed.
- f. For each frequency band the RF bandwidths at the -3, -20, -60 dB levels.
- g. For each emission designator the IF bandwidths at the -3, -20, -60 dB levels for the narrowest IF amplifier.
- h. For each emission designator specify the receiver sensitivity and specify the criteria used.

### 10.8.8 Required Antenna Characteristics Data

Required Antenna Characteristics Data:

- a. The antenna nomenclature/name model number and manufacturer.
- b. The range of frequencies for which it is designed.
- c. The polarization.
- d. The maximum gain and beamwidth.
- e. The maximum gain of the first side lobe and the angular displacement from the main beam.
- f. The generic name and description of the antenna. The EL-CID tool will prompt for specific technical characteristics based on the antenna description.

### 10.8.9 Required Data for Wideband and Narrowband Emission Level and Temporal Measurements in the Navstar Global Positioning System Frequency Bands

When Stage 4 certification is requested for systems (excluding passive systems) operating in the bands 390-413 MHz, and 960-1710 MHz, measured data is to be submitted as specified in Section 8.2.55.

- a. The measured emission levels are to be provided as shown in the example below:

*GPS Wideband emission level: 1164-1240 MHz band is -XX dBW/MHz; 1559-1610 MHz band is -XX dBW/MHz*

*GPS Narrowband emission level: 1164-1240 MHz band is -YY dBW; 1559-1610 MHz band is -YY dBW*

The EL-CID tool will prompt the user to provide the data when appropriate.

- b. For pulsed systems a plot of the relative power level in the 1164.45-1188.45 MHz, 1215.6-1239.6 MHz, and 1563.42-1587.42 MHz bands as a function of time can also be submitted as an attachment to the EL-CID tool.
- c. The guidelines for making the emission level and temporal measurements are provided in Annex M, Sub-Section M.2.1.F of this Manual.

## 10.9 TRUNKED LAND MOBILE DATA REQUIREMENTS

Trunked system review is based on the need to consider the system as a whole, which is not possible with the unconnected and separate frequency proposals made to the FAS.

### 10.9.1 Requests for New Trunked Systems

Requests for certification of spectrum support of trunked land mobile systems must contain all the required data for a mobile systems and the following information for each repeater site:

- a. *The number of channels (frequency pairs) required,*
- b. *The number of users planned, and*
- c. *If the channel loading is less than 100 users per channel, provide justification for the number of channels requested.*
- d. *Operating Location:* Provide the city (or other geographic subdivision) and state.
- e. *Equipment Identification:* Provide the manufacturer and model number/name of the equipment.
- f. *Docket Number of Previous Certification:* Provide the SPS docket number of the NTIA Certification of Spectrum Support for the equipment. If the equipment has not received NTIA Certification of Spectrum Support, provide the equipment characteristics identified in Section 10.8.6 using the EL-CID tool.
- g. *System Overview:* Provide a line diagram representing the system configuration and method of connecting multiple sites. Specify if dispatcher uses phone lines or RF to connect to the base/repeater stations.
- h. *Coverage Information.* Provide the following for each repeater site:
  - 1) Geographical Coordinates: (in degrees, minutes, and seconds)
  - 2) Site Elevation: (in meters above mean sea level)
  - 3) Antenna Height: (in meters above site elevation)
  - 4) Antenna Gain: (in dBi)
  - 5) Transmitter Power: (in watts)
  - 6) Radius of Operation: (in kilometers); or Geographical Plot of Required Coverage Area
- i. *Frequency Requirements:*
  - 1) Frequency Band
  - 2) Number of Frequencies Required
- j. *Total Number of Users*
- k. *Target Date for System Activation*
- l. *Frequency Assignments to Be Replaced by this System:*
  - 1) Assignments to Be Relinquished: Provide the existing Assigned Frequencies, Agency Serial Numbers, and Expected Relinquishment Date.
  - 2) Assignments to Be Used by the Trunked System: For each existing frequency assignment that will be incorporated into the trunked system, provide the existing Assigned Frequencies and Agency Serial Numbers.
- m. *Estimated Initial Cost of the System*
- n. *Separate System Justification:* For trunked land mobile systems that are within 30 km of an existing or planned trunked land mobile system authorized by NTIA, provide the information required under Section 8.2.48A.
- o. *National Security Emergency and Preparedness Function:* A statement as to whether the proposed system, if it becomes operational, will support an NSEP function and require review in accordance with Section 12.15.

### 10.9.2 Requests for Expansion/Additional Channels

Requests for expansion or additional channels for previously certified trunked land mobile systems shall contain the following information:

- a. *Docket Number of Previous Certification*: Provide the SPS docket number of the NTIA Certification of Spectrum Support for the existing trunked system.
- b. *Additional Frequency Requirements*
  - 1) *Number of Additional Frequencies Required*
  - 2) *Rationale for Additional Frequencies*: (e.g., channel loading, queuing times, and new users).
- c. *Details of Expansion*
  - 1) *Additional Repeater Sites*: Provide the information listed in Section 10.9.1, paragraphs 5a-5f, for each additional repeater site.
  - 2) *Additional Users*: Provide the information listed in Section 10.9.1, paragraph 7 for additional users.
- d. *Equipment Identification*
- e. *Target Date for Expansion/Additional Channels Activation*:
- f. *Estimated Cost of this Expansion*
- g. *National Security Emergency and Preparedness Function*: A statement as to whether the proposed system, if it becomes operational, will support a NSEP function and require review in accordance with Section 12.15.

### **10.9.3 Guidelines Regarding Certification of Spectrum Support for Trunked Systems**

1. Certifications of spectrum support for trunked systems with a date of activation exceeding one year from the date of certification will include a recommendation that record note S321 be applied to the corresponding requests for frequency assignment.
2. The SPS will consider whether record note S321 should be applied to existing frequency assignments for systems not activated within one year from the date of certification.
3. The SPS will review the certification of spectrum support for each trunked system not activated within five years from the date of certification. Unless the responsible agency submits adequate justification for an extension of the activation time limit, the SPS will recommend to NTIA that the certification and all associated frequency assignment be revoked.
4. Unless otherwise approved by the SPS, telephone interconnects will be limited to one for each five channels, but no more than three for any size system. A trunked system with telephone interconnect must have the capability to:
  - a. “time-out” the length of telephone messages, and
  - b. control and reduce the number of channels available for telephone interconnect as demand for dispatch calls increases. For planned expansions of trunked systems, the dedicated use and/or blockage caused by telephone interconnect will not be considered as the justification for a request of additional channels.
5. When the SPS recommends spectrum support to NTIA for a new trunked system, the maximum number of channels (frequency pairs) that may be used by the system will be listed in Section 3 of the certification of spectrum support. In arriving at this figure, the SPS uses a basis of 100 subscriber stations per channel. For the purposes of determining compliance with trunked system loading requirements, the term “subscriber stations” includes control (or land) stations as well as vehicular and portable units.
  - a. *New Systems*. A federal agency requesting spectrum support for a new trunked system shall verify that a minimum of 70 subscriber stations for each channel authorized will be placed in operation within five years of the date of the certification of spectrum support.
  - b. *Expansion of Existing Systems*. The SPS will not recommend approval of any request for expansion of an existing trunked system unless the existing system has a loading level of at least 70 subscriber stations per channel.
  - c. *Exceptions*. Exceptions to the above loading criteria will be considered by the SPS on a case-by-case basis. Other factors (for example, the number of required failsoft channels) may be considered in addition to the criteria described above.

## **10.10 ULTRA-WIDEBAND SYSTEMS**

### **10.10.1 Requests for Spectrum Support**

1. For the purposes of the section, a UWB system is defined as “An Intentional radiator that, at any point in

time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.”

2. There are provisions in Section 7.8 of the NTIA Manual for federal agencies to operate systems that conform to the FCC’s rules in 47 CFR Part 15 on a non-licensed, non-interference basis. The 47 CFR, Part 15 includes provisions for non-licensed operation of UWB devices that can be mass-marketed and operated largely without coordination with existing authorized stations.

3. This section provides guidance for agencies seeking to operate UWB systems that cannot conform to the 47 CFR Part 15 rules for non-licensed operations. Such devices, like the non-licensed UWB systems, may only operate on a non-interference basis to stations operating in accordance with the allocation tables. Since UWB systems that do not conform to Part 15 provisions will require certification of spectrum support, authorization for these UWB systems will be provided only when the requesting agency provides a suitable analysis and operating restrictions can be made to ensure compatible operation with existing authorized stations.

4. The requirements of this section do not apply to systems such as radars, fixed, or fixed-satellite systems with bandwidths greater than 500 MHz that are operated in bands that have been allocated sufficient bandwidth for such intended operations (e.g. 71-76 GHz, 92-95 GHz).

5. All requests for spectrum support of UWB systems must be accompanied by a satisfactory justification for such operations.

6. Requests involving UWB systems developed by federal agencies, or those commercially available but without an FCC-type acceptance number, must initially be submitted at Stage 1, 2, or 3.

7. All Stage 2, 3, and 4 requests must contain spectrum measurements and EMC analyses demonstrating the system's degree of electromagnetic compatibility with authorized services in the intended operating bands, adjacent bands, and possible harmonically related frequency bands, as described in Sections 10.10.3 and 10.10.4 below.

## **10.10.2 Spectrum Certification Procedures**

Federal agencies desiring to deploy UWB systems that do not conform to Section 7.8 must request spectrum support in accordance with this section. In response to spectrum support requests for such systems, NTIA, with the assistance of SPS and FCC guidance, will consider the frequency range of operation, develop a list ("List") of systems that must be considered when evaluating the compatibility of the proposed UWB use. NTIA will use the analysis methods provided in NTIA Special Publications 01-43, 01-45, 01-47, relevant ITU-R Recommendations, and other appropriate sources, as the basis to develop coordination trigger distances for each of the systems on the list. Receiver interference criteria specified in the NTIA Receiver Interference handbook "Communications Receiver Performance Degradation Handbook" Document Control No. JSC-CR-10-004" must be used unless none is specified for a given receiver in the environment. In developing the coordination trigger distances, NTIA may, as necessary, also take into consideration other UWB application-specific factors (e.g., aggregate interference). The submitting agency will evaluate the intended location(s) of the proposed UWB system in terms of these coordination trigger distances with respect to systems on the list. If the proposed UWB location falls outside of the established distances, then the application may receive spectrum support. If its location falls within the established distances, then the requesting agency will have to work with the affected agency(ies) or licensee(s). As part of this effort, measurements, or more detailed analyses, performed in cooperation with the affected agency(ies) or licensee(s), may be required. Such measurements or analyses may demonstrate, through consideration of additional technical factors or system characteristics, that the proposed UWB system is compatible with authorized systems on the list or may be operated at a distance less than the coordination trigger distance. Such measurements or analyses may require the support of the potentially impacted agency(ies) or licensee(s), including making the potentially impacted system or systems available for measurements. Where the measurements or analyses show compatibility, NTIA may grant spectrum support. Furthermore, any measurements or analyses used to establish compatibility will become a resource to be considered in future spectrum support assessments for the supported UWB system at other locations.

## **10.10.3 Electromagnetic Compatibility**

1. In order to assure EMC, agencies responsible for UWB operations shall:
  - a. At a minimum, ensure protection of safety-of-life, radionavigation satellite, search and rescue,



satellite uplink, satellite downlink, passive sensing, radio astronomy, and aeronautical radionavigation operations.

b. In a timely manner, coordinate with other agency(ies) or licensee(s) that may be affected and may include provisions for real-time coordination during the period the UWB system is in operation.

c. Immediately suspend such operations upon the request of an affected agency(ies) or licensee(s) in the event that the UWB system causes harmful interference to authorized stations.

2. All Stage 2, 3, or 4 requests must include an analysis demonstrating the system's degree of EMC with authorized services in the intended operating bands, adjacent bands, and possible harmonic frequency bands as per Section 10.8.1.9 (Non-Conforming Operations) and must specifically include "details of how operations on a non-interference basis are feasible."

3. In frequency bands subject to footnote US246, the EMC analysis must show that there will be no impact upon radio astronomy observations and passive sensing operations. Various EMC methods may include:

a. an analysis showing evidence that the selection of operating locations will ensure protection of radio astronomy observations and Earth Exploration-Satellite Service passive sensing operations;

b. descriptions of design techniques incorporated in the UWB system for protecting radio astronomy observations and Earth Exploration-Satellite Service sensor operations, such as attenuating emissions through filtering; or

c. the use of interference levels specified by ITU-R Recommendation RA.769-2 or RS.1029-2 as a coordination trigger with the radio astronomy and Earth Exploration-Satellite Service passive sensor operations (If the UWB system emission levels are below the interference levels specified in ITU-R Recommendation RA.769-2 or RS.1029-21, coordination is not required).

4. The analysis must clearly indicate the e.i.r.p. of the system expressed as average power per MHz based on the r.m.s. voltage as a function of frequency and victim receiver bandwidth, antenna gains, losses, propagation path losses, and the interference criteria of the victim receiver used in the analysis. For additional information on the details of performing EMC analyses, see ECAC-TN-78-005 EMC Analysis Handbook, NTIA Special Publication 01-43, and NTIA Technical Memorandum 04-408.

5. Additional power losses due to "terrain, foliage, or building shielding" or other phenomenon included in the analysis must only be applied where it can be clearly demonstrated that such losses will occur consistently in all plausible operational scenarios. Polarization mismatch losses must not be considered in the analysis. Such mismatches are only applicable where both the transmitter and receiver are fixed, and are within each-others mainbeam.

#### **10.10.4 Spectrum Measurements**

1. Stage 3 and 4 requests must contain a spectrum signature measured in an anechoic chamber to a level at least 20 dB below the maximum value of the emission level of the system when measured as described herein. Stage 2 requests must include either a calculated or measured spectrum signature. Depending on the magnitude of the emission level, measurement data might be required at even lower levels. (This level is 10 dB below the necessary bandwidth. Measurement to this level is not required for non-licensed devices since the power levels are generally low enough to be practicably unmeasurable at levels 20 dB below the maximum emission without specialized measurement equipment with very low noise figures.) The spectrum analyzer (SA) (or other suitable measurement instrument) used for the measurements must have an r.m.s. detector function. The r.m.s. average field strength of the emission spectrum must be measured over the entire -20 dB emission bandwidth with a 1 MHz resolution bandwidth and a video bandwidth greater than or equal to 1 MHz. Although a video bandwidth setting of 10 times the resolution bandwidth is generally recommended for this type of measurement, it is recognized that most SAs will typically have a maximum video bandwidth of 3 MHz and if available should be used. Where practicable, the SA should have sufficient dynamic range. The averaging time for the r.m.s. measurement is to be 1 millisecond or less. If the UWB system employs pulse gating, in which the transmitter is quiescent for intervals that are long compared to the pulse repetition interval, all measurements are to be made while the pulse train is gated on. Peak radiated emission measurements must be made using a spectrum analyzer with a 3 MHz RBW and no less than a 3 MHz VBW. The SA should be used in a maximum-hold trace mode. Additional measurements must be made in the frequency bands 1164-1240 MHz and 1559-1610 MHz with a resolution bandwidth of no less than 1 kHz.

2. To the maximum extent possible, the field strength measurements should be performed with the UWB system under test as it is intended to be used in actual operating conditions. The radiated field strength measurements must be made using the antenna to be employed with the UWB system under test. The measurement antenna must

be sufficiently broad-band to cover the frequency range of the measurements, and the use of multiple measurement antennas may be required. All measurement antennas must be accurately calibrated and must demonstrate low phase dispersion over the frequency range of the measurement. The orientation of the measurement antenna must be varied horizontally and vertically to determine the point that maximizes the measured field strength.

a. The spectrum to be measured should include at least the fundamental emission and the secondary lobe regardless of the center frequency. The frequency spectrum must be measured from the lowest frequency generated within the UWB system, without going below 9 kHz, up to an upper frequency defined by adding three divided by the pulse width in seconds to the center frequency in Hz.

b. A measurement showing the SA noise floor level must also be included so that it may be clearly distinguished from the emission spectrum of the UWB system under test.

c. The resultant field strength plots must indicate the measurement distance.

d. The resultant graphs must be corrected to account for amplifiers, attenuators, cables, and antennas used in the measurements before the information is submitted.

e. The measured data presented must be a composite of the maximum measurements of field strength of both horizontal and vertical polarization at each frequency and indicate the measurement distance.

f. The measured field strength levels should then be converted to e.i.r.p. (i.e. dBm or dBW) that may be used directly in EMC analyses without further conversion using the following equations:

$$\text{e.i.r.p.} = E_o + 20 \log(D) - 104.8 \text{ (dBm)}$$

$$\text{e.i.r.p.} = E_o + 20 \log(D) - 134.8 \text{ (dBW)}$$

where

$E_o$  is the field strength in dB

$D$  is the measurement distance in meters.

g. The measured data must be presented in graphical form with sufficient resolution for analytical purposes and be properly and clearly labeled.

**(Last Page in Chapter 10)**

## Chapter 11

### Public Access to the Federal Spectrum Management Process

#### 11.1 PREFACE

This Chapter sets forth policies and general guidance for the public to provide advice or information to NTIA regarding spectrum management issues and to obtain information regarding NTIA activity and federal use of the radio spectrum. Sections 104(a) and (b) of the National Telecommunications and Information Administration Organization Act (Act), P.L. 102-538, codified at 47 U.S.C. 903 direct the Secretary of Commerce and NTIA to improve federal spectrum management activities by (1) providing for a period at the beginning of each meeting of the Interdepartment Radio Advisory Committee to be open to the public to make presentations and receive advice, and provide the public with other meaningful opportunities to make presentations and receive advice; (2) publishing major spectrum management policy proposals that are not classified and that involve spectrum management, with adequate opportunity for public review and comment; (3) publishing major policy decisions that are not classified and that involve spectrum management; (4) making available nonclassified spectrum management information to the public, including access to electronic databases; and (5) providing prompt and impartial consideration of requests for access to federal spectrum by the public, including disclosure of the status and ultimate disposition of any such request.

#### 11.2 OPPORTUNITIES FOR THE PUBLIC TO PROVIDE INFORMATION AND ADVICE TO NTIA

The public may at any time provide advice or information to NTIA staff regarding spectrum management issues. Contact information is provided at NTIA's website <https://www.ntia.gov/>.

#### 11.3 INFORMATION REGARDING NTIA SPECTRUM MANAGEMENT ACTIVITIES

Information regarding NTIA spectrum management activities may be found at NTIA's website <https://www.ntia.gov/> under "Spectrum Management".

#### 11.4 PUBLIC PRESENTATIONS TO OR RECEIVING ADVICE FROM THE IRAC

1. Members of the public who would like to make a presentation to or receive advice from the IRAC should contact the IRAC Chairperson, the Deputy Associate Administrator for Domestic Spectrum Management at least two weeks before the intended IRAC meeting. If the Chairperson deems the subject to be in accordance with the guidance below, the IRAC Executive Secretary will place the item on an appropriate IRAC agenda. A period of up to 20 minutes will normally be provided for any presentation with additional time for responses from the IRAC.

2. Members of the public who are preparing presentations to the IRAC should consider the following: (1) the IRAC serves in an advisory capacity to NTIA and the Assistant Secretary for Communications and Information relative to spectrum issues and is not the Executive Branch decision body on spectrum management issues; (2) the member-agency representatives manage, or coordinate, spectrum use by diverse types of radiocommunications facilities and services in their respective agencies; (3) some of these services are obtained from federally-owned facilities and some are obtained from privately-owned facilities; and (4) the member-agency representatives generally do not award grants or contracts for radio facilities or services of their respective agencies; (5) the IRAC awards neither grants nor contracts of any kind. Presentations to the IRAC by the public may include the following:

- a. Descriptions of developing technologies or innovative applications of existing technologies that are relevant to radio frequency spectrum management or usage.
- b. Proposals for new radiocommunication services or improved approaches for spectrum management.
- c. Comments on spectrum issues currently being addressed by the IRAC.

3. Information provided by the public during the open portions of IRAC meetings shall have no distribution restrictions.

4. When plans have been made for members of the public to make a presentation to or receive advice from the IRAC, an announcement shall be placed on the NTIA website at <https://www.ntia.gov/page/interdepartment-radio-advisory-committee-irac>. This announcement shall (1) define the subject to be addressed; (2) indicate the scheduled

date and place for the presentation; (3) provide a brief summary of the scheduled presentation; and (4) identify an individual who can answer detailed questions regarding the scheduled presentation and access procedures.

5. Members of the public desiring to attend a scheduled open portion of an IRAC meeting should contact the IRAC Secretariat in advance of the meeting date to ensure that adequate seating and security escort can be made available for the meeting. During the open portions of IRAC meetings, questions and comments by members of the public on presentations by others should be addressed to the IRAC Chairman.

## **11.5 REQUESTING FEDERAL GOVERNMENT SPECTRUM MANAGEMENT INFORMATION**

1. A large amount of information related to federal spectrum management is available on NTIA's website at <https://www.ntia.gov/>. For example, the website includes the Manual of Regulations and Procedures for Federal Radio Frequency Management (NTIA Manual), the U.S. Frequency Allocation Chart, spectrum studies and reports, and NTIA's spectrum filings before the FCC. Information not available on the website may be available through a Freedom of Information Act request.

2. A FOIA request to NTIA, U.S. Department of Commerce, should include the following:

- The request must be in writing and can be submitted by mail, e-mail, or fax.
- A statement that the request is being made under the FOIA must be included in the letter.
- Mark the envelope "Freedom of Information Act Request."
- If making the request by e-mail, please include a mailing address.
- Please also include a daytime telephone number if clarification is needed.

3. Send your request to:

FOIA Officer  
National Telecommunications and Information Administration  
U.S. Department of Commerce  
1401 Constitution Avenue, N.W., Room 4713  
Washington, DC 20230  
E-mail address: [eFOIA@ntia.gov](mailto:eFOIA@ntia.gov)  
Fax number: (202) 501-8013  
Telephone number: (202) 482-1816

4. Please describe as best as possible the NTIA records requested. In the description, please include information regarding the subject matter, date, and any other information that will assist NTIA in this record search.

## **11.6 REQUESTING ACCESS TO SPECTRUM ALLOCATED FOR FEDERAL GOVERNMENT USE**

1. NTIA shall provide prompt and impartial consideration to all public requests for access to those portions of the spectrum that are allocated for federal use.

2. All requests for use of spectrum that is allocated on an exclusive basis for federal use or on a shared basis for federal and non-federal use are submitted to the FCC as the regulator of non-federal use of the radio spectrum. Such requests are coordinated with NTIA, with assistance from the IRAC FAS, to determine the likely impact on federal existing and planned spectrum use. The FCC informs the requester of the results of this coordination.

3. When the public desires to seek NTIA consideration of a proposal for reallocation of spectrum, requests should be submitted in writing to the Deputy Associate Administrator of Domestic Spectrum Management.

4. The requests should, as appropriate, include the following information:

- a. The radio frequency band or bands affected;
- b. The reasons why the requirement for radio frequency spectrum use cannot be accommodated within spectrum allocated for non-federal use;
- c. The likely impact on the radiocommunication services currently using the spectrum;
- d. The radiocommunication service proposed and a functional description, including technical parameters;
- e. The geographic area to be served by the proposed radiocommunication service;
- f. The planned schedule for implementing the proposed radiocommunication service;

- g. A description of the actions by the FCC on the request; and
- h. The name, address, telephone number, and facsimile number of the individual who can be contacted for more information regarding the request.

5. Upon receipt of such a request, the Deputy Associate Administrator for Domestic Spectrum Management shall notify the FCC of the request and shall advise the FCC of any preliminary conclusions. All allocations for non-federal use are provided through the FCC. The request and any NTIA response to the requester shall be made available to the public via the NTIA website.

## **11.7 PUBLICATION OF MAJOR FEDERAL SPECTRUM MANAGEMENT PROPOSALS AND DECISIONS**

All major nonclassified policy proposals and decisions involving federal spectrum management shall be published in the Federal Register. When policy proposals are published, specific procedures shall be included for the public to submit comments to NTIA. In addition to publishing major policy proposals and decisions in the Federal Register, summaries of current federal spectrum management activities that are of general interest shall be made available to the public through the NTIA website.

**(Last Page in Chapter 11)**

## Chapter 12

### Emergency Readiness Planning

#### 12.1 OVERVIEW

This plan addresses Federal spectrum use and management actions necessary to support an immediate response to emergency situations, e.g. mobilizing for, responding to, and recovering from all emergency situations, and the mechanisms by which the Federal Government will use and manage the radio spectrum relative to National Security and Emergency Preparedness (NS/EP) radio communications for the Federal Government. The plan coupled with NTIA's Continuity of Operations (COOP) plan and other Federal departments and agencies COOP plans, support accomplishing NTIA's Primary Mission Essential Function (PMEF) of Federal spectrum management during emergency situations. The plan also serves as a baseline for the Director of the Office of Science and Technology Policy (OSTP) or his/her designee to advise and assist the President in the administration of a system of radio spectrum priorities for those spectrum-dependent telecommunications resources of the Federal Government which support NS/EP functions.

Whenever possible, normal policies and procedures governing federal spectrum management contained elsewhere in this Manual should be followed. The procedures contained in this section relate to any emergency occasion, instance, or situation which require a federal response not covered by normal spectrum management policies and procedures. Specific NTIA policies for spectrum use and management in support of a response to emergency situations include:

- Continuing, insofar as possible, use of existing frequency assignments;
- Continuing to coordinate frequency assignments through NTIA Headquarters;
- Emphasizing the need to preplan the use and management of radio spectrum before emergencies arise;
- Ensuring that all agency communications are electromagnetically compatible with other users to reduce the possibility of interference;
- Providing for federal, military, and civil, spectrum needs determined by a competent authority;
- Assuring use of the radio spectrum conforms to national priorities established by the Director of the Office of Science and Technology Policy (OSTP) as stated in the NTIA *Emergency Readiness Plan for the Use of the Radio Frequency Spectrum* (ERP), or by other competent authority;
- Providing, with minimal disruption to other services, radio spectrum resources as necessary to satisfy federal emergency response requirements; and
- Recommending adjustments to spectrum use when situations require.

#### 12.2 NATIONAL SECURITY AND WAR EMERGENCY COMMUNICATIONS

1. Upon proclamation by the President of war, threat of war, state of public peril or disaster or other national emergency, or in order to preserve the neutrality of the United States, the President may exercise war emergency powers pursuant to 47 U.S.C. § 606. The OSTP Director will execute these powers under 47 C.F.R. § 214.6. Under 47 C.F.R. § 202.1 (f), and subject to the overriding control of the OSTP Director under the President's war emergency powers, NTIA will continue to authorize and assign radio frequencies until otherwise directed.

2. The OSTP Director bears overall responsibility for the development and approval of radio spectrum priorities supporting the NS/EP telecommunications functions of the Federal Government. In 47 C.F.R. § 202.3 (c)(2) & (e)(1)(i), the OSTP Memorandum for the Secretary of Commerce, National Security Emergency Preparedness Priority System for Government-Owned/Leased Spectrum-Dependent Telecommunications Systems (May 19, 1989), designated NTIA as the agency to develop this system of priorities. NTIA has developed the Telecommunication Service Priorities for Radio (TSP-R) accordingly. The ERP contains procedures for agencies to designate the appropriate TSP-R for their spectrum-dependent systems.

3. The ERP contains further guidance on spectrum use during these emergencies. NTIA prepares, maintains and disseminates the ERP, and ensures that it accurately reflects the projected NS/EP spectrum usage and priority requirements of federal departments and agencies.

## 12.3 SPECTRUM MANAGEMENT IN SUPPORT OF THE NATIONAL RESPONSE FRAMEWORK (NON-WARTIME)

1. In the case of an emergency where Federal Emergency Management Agency (FEMA) activates procedures in accordance with the National Response Framework (NRF), NTIA will continue to perform its frequency management functions at its Headquarters, whether at the home office in Washington, DC or at its Continuity of Operations (COOP) sites. Thus, processing of all frequency assignment requests continues to follow current published procedures. NTIA may also deploy spectrum managers to the emergency area as necessary to perform a liaison representing NTIA.

2. In the event of Department of Defense (DOD) involvement, the Defense Coordinating Officer (DCO) or Joint Task Force, will establish a Joint Spectrum Management Element (JSME) in accordance with Chairman of the Joint Chiefs of Staff Instruction 3320.01B, with DOD Joint Publication 6-01, Annex A to ACP 190 and other applicable procedures and guidelines. The JSME spectrum manager serves as the single point of contact for joint or single service task forces temporary or permanent spectrum requirements. The JSME forwards requirements through the appropriate military channels. In all instances, spectrum coordination will not be completed until the NTIA Office of Spectrum Management (OSM) Frequency Assignment Branch validates the spectrum use and authorizes a frequency assignment.

3. The deployed NTIA spectrum liaison will manage the use of the Federal radio frequency spectrum, coordinate Federal radio frequency interoperability, coordinate Federal telecommunications assistance to local, state, tribal, territorial, and insular area governments and resolves radio frequency use conflicts in the Joint Field Office or disaster area. The NTIA Liaison will assist agencies, as necessary, in forwarding requests to their appropriate agency headquarters or, if necessary, to NTIA for assignment action. All frequency requests must be processed through NTIA Headquarters.

## 12.4 EMERGENCY COMMUNICATIONS FOR WHICH AN IMMEDIATE DANGER EXISTS TO HUMAN LIFE OR PROPERTY

1. In situations where immediate danger exists to human life or property, an agency may operate temporarily on any regularly assigned frequency in a manner other than that specified in the terms of an existing assignment. Emergency operations under such situations should continue only as long as necessary to ensure that the danger to human life or property no longer exists. Emergency operations under these circumstances shall be reevaluated on a regular basis until such time as normal/routine operations can be reestablished.

2. Interoperable communications for disaster/emergency response involving federal, state, local, and tribal entities shall be in conformance with Section 12.15 of this Manual. Additional information regarding interoperable communications can also be found in the National Interoperability Field Operations Guide promulgated by the Department of Homeland Security.

## 12.5 FREQUENCIES FOR THE SAFETY OF LIFE AND PROPERTY

1. Aircraft, ship, survival craft and mobile earth stations may use the following frequencies provided such use is in accordance with the ITU Radio Regulations Article 5, Chapter VII and Appendix 15:

- a. Frequencies designated for use by ships for radiotelephone distress and safety traffic.

2182 kHz <sup>1</sup>	4125 kHz	6215 kHz	8291 kHz
12290 kHz	16420 kHz	156.8 MHz (VHF FM Channel 16)	

- b. Frequencies designated for use by ships using Digital Selective Calling for distress and safety calls.

2187.5 kHz <sup>1</sup>	4207.5 kHz	6312.0 kHz	8414.5 kHz
12577.0 kHz	16804.5 kHz	156.525 MHz (VHF Channel 70)	

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<sup>1</sup> GMDSS is mandated for ships internationally by the International Maritime Organization (IMO) Safety of Life at Sea Convention (SOLAS), however USCG no longer monitors these frequencies



c. Frequencies designated for use by ships for Distress, Urgent and Safety traffic using radiotelex or narrow band direct printing.

2174.5 kHz	4177.5 kHz	6268.0 kHz
8376.5 kHz	12520.0 kHz	16695.0 kHz

d. Frequencies designated for use by ship, aircraft and shore stations utilizing radiotelephony during coordinated search and rescue operations.

3023 kHz	5680 kHz	123.1 MHz
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e. Frequencies designated by aircraft stations in addition to their normal air/ground communications channel(s) for distress, urgent, safety and calling purposes.

121.5 MHz	243.0 MHz
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f. Frequencies designated by mobile earth stations for distress, urgent and safety communications.

1626.5-1645.5 MHz	1645.5-1646.5 MHz
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2. Ship stations may use the frequencies 156.650 and 156.375 MHz for ship-to-ship and ship-to-shore communications related to the safety of navigation in accordance with the Vessel Bridge-to-Bridge Radiotelephone Act (Public Law 92-63). (See ITU Radio Regulation Article 33, RR 33.52 and Section 8.2.29 of this Manual.)

3. Ship, survival craft and search and rescue aircraft stations may use the frequencies 161.975 and 162.025 MHz for automatic identification system purposes (see ITU Radio Regulation Article 5, Ap. 15 and 18).

4. The provisions of this Manual do not prevent mobile stations, or mobile earth stations, in distress from using any frequency at its disposal to attract attention, make known its position, and obtain help. (See ITU Radio Regulation Article 4, RR 4.9 and Article 30, RR 30.2)

5. To enhance protection of life and property, it is mandatory that each Emergency Position Indicating Radiobeacon (EPIRB), Emergency Locating Transmitter or Personal Locator Beacon operating on 406.025 MHz be registered with NOAA. Agencies shall advise the National Oceanic and Atmospheric Administration (NOAA) in writing of any change in registration information. Initial registration forms are provided by the equipment manufacturer. NOAA will provide registrants with confirmation of registration and change of registration postcards. NOAA's address is: NOAA, SARSAT Beacon Registration, NSOF, E/SPO53, 1315 East West Hwy, Silver Spring, MD 20910. As an alternative, agencies may make special arrangements for the registration of these devices directly with the NOAA National Environmental Satellite, Data, and Information Service (NESDIS) Search and Rescue Satellite Aided Tracking (SARSAT) Operations Division.

## **12.6 FREQUENCIES FOR COORDINATING SEARCH AND RESCUE OPERATIONS**

1. The carrier frequencies 3023 and 5680 kHz (ITU Radio Regulation Article 31, Ap. 15 and 27) may be used by mobile stations for intercommunication between mobile stations engaged in coordinated search and rescue operations, including communication between the mobile stations and participating land stations, provided such use is in accordance with the provisions of the ITU Radio Regulations. Federal mobile stations shall use J3E emission, upper sideband only, when all stations participating in a search and rescue operation are capable of using that emission. Emissions A1A, A3E or H3E may also be used if necessary.

2. The frequency 123.1 MHz, using class A3E emission, may be used by stations of the aeronautical mobile service and by other mobile and land stations engaged in coordinated search and rescue operations.

3. The frequency 156.3 MHz may be used for communications between ship stations and aircraft stations, using G3E emission, engaged in coordinated search and rescue (SAR) operations. When control of the scene of a SAR incident is under a U.S. Coast Guard coast station, 156.3 MHz may be used by ship stations to communicate with that coast station.

## **12.7 FREQUENCIES FOR MARINE ENVIRONMENTAL PROTECTION OPERATIONS**

The frequency 157.075 MHz, 16K0F3E emission, may be used by mobile stations, and for portable-type operations, for communications required to coordinate marine environmental protection operations, e.g., communications pursuant to the Joint Canada-United States Marine Contingency Plan for Spills of Oil and Other Noxious Substances. All use of this frequency under this authority shall be in accordance with plans formulated by competent environment-protection authorities and shall be under the operational control of the designated on-scene commander/coordinator or deputy on-scene commander/coordinator.

## **12.8 EMERGENCY USE OF NON-FEDERAL FREQUENCIES**

In emergency situations, a federal radio station may utilize any frequency authorized to a non-federal radio station, under Part 90 of the FCC Rules and Regulations, when such use is necessary for communications with the authorized non-federal stations and is directly related to the emergency at hand. Such use is subject to the following conditions:

- The non-federal licensee has given verbal or written concurrence;
- Operations are conducted in accordance with the FCC Rules and Regulations;
- Use is restricted to the service area and station authorization of the licensee;
- All operations are under the direct control of the licensee and shall be immediately terminated when directed by the licensee;
- Operations do not exceed 60 days; and,
- The federal agency shall provide, through the agency's FAS representative to the FCC as soon as practicable, a written report of each such use.

## **12.9 FIRST RESPONDER NETWORK; NATIONWIDE PUBLIC SAFETY BROADBAND NETWORK**

1. Public Law 112-96, February 22, 2012 established the First Responder Network Authority within the NTIA to plan for and oversee the development, deployment and operation of the Nationwide Public Safety Broadband Network (NPSBN). The FirstNet Authority holds the sole, nationwide license for Long Term Evolution Band-14 (788 – 798MHz - 758 – 768MHz) through Part 90 of the FCC Rules and Regulations.

2. Operation of the NPSBN is essential to Federal and civil authorities conducting National Security/Emergency Preparedness operations day-to-day as well as during planned and unplanned events in support of the National Security Posture and Public Health, Safety and Maintenance of Law and Order. Federal departments and agencies wishing to access Band-14 spectrum will only do so through a subscription service or as part of an overall support to FirstNet subscribers at all levels of government within the operational area. Agencies should avoid procurement of transportable Advanced Wireless Service (AWS), Cellular, and Personal Communications Services (PCS) Systems including Cell-on-Wheels (COW), Cell on Light Truck (COLT) or other transportable or deployable systems operating in Band-14.d.

3. Wideband, spectrum-dependent systems used by Federal departments and agencies must avoid causing interference to the operation of the NPSBN as an NS/EP, public safety network when used within the US, USA, USP, Statewide or other area assignments.

## **12.10 COORDINATION AND USE OF EMERGENCY NETWORKS**

1. FEMA National Emergency Coordination Net (NECN): After coordination with the FEMA program manager for FEMA National Radio System (FNARS), federal high frequency (HF) radio stations are authorized to communicate with stations operating on the NECN when necessary for coordination in relation to NS/EP response efforts including tests and exercises. NECN provides pre-designated and ad hoc frequencies to support NS/EP response efforts. These frequencies are a virtual "meeting place" where responders from different agencies can make contact to coordinate their activities, exchange operational information, and receive support (such as relay, phone patch, information lookup, and third-party message handling) from the FEMA radio operators or other stations on the Net.

- a. The NECN provides the following:

- (1) Communications support to federal agencies that need to contact FEMA during NS/EP response efforts;
  - (2) Interoperability communications support between federal agencies and state emergency operations centers via the FEMA HF radios installed there during NS/EP response efforts;
  - (3) High-power HF stations with emergency generator backup power, staffed by federal or state employees; and,
  - (4) Capability for secure voice and data communications (These communications are exercised quarterly).
- b. The NECN maintains a watch for expected traffic from stations directly involved in an emergency response or those stations communicating with stations directly involved in an emergency response.
  - c. Agencies should contact the FEMA FNARS program manager to arrange for access to the NECN:

FNARS Program Manager  
DHS/FEMA MWEOC  
19844 Blue Ridge Mountain Road  
Mount Weather, VA 20135  
Telephone: 540-542-2249

2. The SHARED RESOURCES (SHARES) High Frequency Radio Program: The IRAC, in coordination with the federal departments and agencies that made up what was formed (known as the National Communications System), established the SHARES HF Radio Program<sup>2</sup>. Federal agencies may use SHARES as a means of passing message traffic when their own networks are not available. Agencies participating in SHARES will accept SHARES traffic at their own discretion. Each agency determines if emergency message traffic (including test and exercise traffic) can be handled, and if it can, the best means of delivery, given the agency's requirements.

- a. Participation in SHARES requires a common understanding and acceptance of procedures. These procedures are contained in the SHARES manual.

- b. Frequency assignments made available by participating agencies for use in SHARES must have a US, USA, USP, or area assignment in the GMF, with Record Notes S296 and S381. Additionally, the Circuit Remarks field must contain \*NTS,M002, IRAC 24902 which defines the SHARES Radio Program concept of operation. Operations under these assignments by agencies other than the one to which the assignment is issued are limited to SHARES operations and tests. Participating agencies in SHARES are authorized to make test transmissions on a non-interference basis to the agency holding the frequency assignment.

3. Use of 5167.5 kHz in the State of Alaska: U.S. Government stations may use the frequency 5168.9 kHz (carrier reference frequency 5167.5 kHz) with maximum power of 150 watts Peak Envelope Power (PEP) for emergency communications in the State of Alaska. Airborne stations are not authorized to use this frequency. Stations operating on this frequency shall be located within the State of Alaska or within 92 kilometers of its boundaries.

4. Federal Communications with Radio Amateur Civil Emergency Service Stations: Federal radio stations are authorized to communicate with stations in the Radio Amateur Civil Emergency Service (RACES) in accordance with FCC rules covered in 47 C.F.R. § 97.407.

## **12.11 USE OF AMATEUR RADIO HIGH FREQUENCY EQUIPMENT FOR EMERGENCY COMMUNICATIONS**

Use of Amateur High Frequency (HF) radio equipment meeting the standards for unwanted emissions specified in 47 CFR, Section 97.307 is permitted on Federal SHARES or Military Auxiliary Radio System (MARS) network frequencies when authorized by the National Coordinating Center for Communications (NCC) or Department of Defense, respectively, as part of either the SHARES or MARS networks. The use of such equipment will be limited to national security or emergency preparedness events as well as DOD sponsored MARS operations.

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<sup>2</sup> See IRAC Document 24902/1, A Concept of Operations for a Shared Resources High Frequency Network ("SHARES").

## **12.12 DEPLOYMENT OF SPECTRUM DEPENDENT SYSTEMS**

1. For systems with US, USA, USP, statewide and other similar area assignments in the GMF that have no specific coordinates, agencies shall notify NTIA that the agency intends to use the assignment in the affected emergency area. This includes all spectrum-dependent systems being deployed into the emergency area, or any existing area assignment within the emergency area that requires additional frequency authorizations.

2. Agencies should coordinate planned deployment of any emitters prior to entry into the emergency area. Upon entry into the emergency area, users will coordinate with their agency's spectrum management personnel, including any deployed personnel supporting the NRF. Any requests for frequency authorizations are to be forwarded to NTIA Headquarters for approval. Except as covered by Section 12.4, agencies shall, prior to operation, coordinate and receive approval by NTIA for all radio use intended for operation in the emergency area. Should an existing/incumbent system in the affected area no longer be operational, NTIA may authorize reuse of assigned frequencies or frequency allotments to support new operations. The reuse of these assigned frequencies or frequency allotments will be coordinated for use on a temporary basis or until such time as the original user is prepared to re-establish operations under the parameters of the original authorization. Should the emergency area fall within the area of responsibility of a DOD Area Frequency Coordinator (AFC) and requirements include spectrum covered under Section 8.3.25, the user will coordinate with the DCO prior to requesting authorization through NTIA.

## **12.13 STATUS REPORTING PROCEDURES**

Based on circumstances of a specific event, NTIA will direct the IRAC agencies to report information relative to spectrum-dependent systems within a disaster/emergency area. Non-member agencies will report through their point of contact in the OSM Frequency Assignment Branch. IRAC members and non-member agencies will keep NTIA informed regarding any changes to that status throughout the response/recovery period so that the appropriate adjustments can be made to the national-level databases.

## **12.14 ESTABLISHING INTEROPERABILITY BETWEEN FEDERAL ENTITIES AND NON-FEDERAL PUBLIC SAFETY ENTITIES**

1. Interoperability may be established between federal entities and non-federal public safety licensees via a memorandum of understanding (MOU). The MOU must be agreed to by the federal and non-federal public safety entities.

2. One method of achieving interoperability involves the use of a passive cross patch switch that is installed on the non-federal public safety entity's transmitter. It is important to note that the attachment of any device to the FCC licensed transmitter has the potential to alter the operating characteristics of the transmitter. However, if the crosspatch switch is passive and does not alter the transmitting characteristics of the licensed non-federal public safety entity's transmitter, no modified FCC issued license is necessary to permit operation of the non-federal public safety entity's transmitter with the passive cross patch switch.

## **12.15 TELECOMMUNICATIONS SERVICE PRIORITY FOR RADIOCOMMUNICATIONS**

1. Executive Order 13618, dated July 6, 2012, specifies in Section 5.3 (f) that: "The Secretary of Commerce shall administer a system of radio spectrum priorities for Federal Government spectrum-dependent telecommunication resources and certify or approve such radio spectrum priorities, including the resolution of conflicts in or among such radio spectrum priorities during a crisis or emergency." NTIA, with advice from the EPS, will certify or approve NS/EP spectrum dependent systems and assign the appropriate TSP-R (spectrum use priority), resolve conflicts in or among TSP-Rs during a crisis or emergency. The TSP-R definitions that are listed in this chapter are compatible with the Department of Homeland Security Telecommunications Service Priority (TSP) System for NS/EP.

2. The TSP-R establishes a consistent frame of reference for departments and agencies in assessing the relative importance of their spectrum-use requirements based on the established priorities of the missions they support in a national security and emergency preparedness situation. The Associate Administrator, Office of Spectrum Management, may weigh such TSP-Rs against the priorities established by the Executive Office of the President should conflicting or competing demands for spectrum-use arise. Thus, the TSP-Rs collectively serve as a baseline

for the Associate Administrator, Office of Spectrum Management (OSM) to advise and assist the President in the administration of a system of spectrum-use priorities for those spectrum-dependent telecommunications resources of the Federal Government that support NS/EP functions. In addition, they delineate specific priorities for radio spectrum use by the Federal Government under all conditions of crisis or emergency.

3. A designation of a TSP-R in department and agency emergency spectrum management plans does not replace or substitute requirements specified in the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management pertaining to authorized frequency assignments.

4. This system of telecommunications service priorities for radiocommunications is consistent with the DHS TSP system as delineated in the Office of Emergency Communications Telecommunications Service Priority Operations Guide, December 2016.

5. A TSP-R shall be assigned for each radio communication system that a department or agency determines will support an NS/EP function. The IRAC, EPS shall review each TSP-R requested by a department or agency, attempt to resolve any conflict with competing spectrum-dependent systems in accordance with appropriate directives, and recommend an appropriate TSP-R. The IRAC and ultimately the Associate Administrator(OSM) will adjudicate all unresolved conflicts.

6. Federal Government spectrum-dependent radiocommunications systems, assigned a TSP-R are considered critical and require continual uninterrupted operation. Radio communication systems supporting national security emergency preparedness qualify for a TSP-R by directly supporting or resulting from at least one of the following:

a. A National Command Authorities declared state of crisis (i.e., the President exercises the authorities assigned under Section 706 of the Communications Act of 1934, as amended (47 U.S. C. 606)), during a crisis, an emergency, or a complex catastrophe, where such situations place a severe demand on spectrum resources that there is a need to prioritize the assignment of radio frequencies:

b. Response to an enemy or terrorist action, civil disturbance, natural disaster, or any other unpredictable occurrence that has damaged facilities whose anticipated operation is critical to NS/EP or the management of other ongoing crises:

c. Certification by the head or director of a Federal Government agency, commander of a unified/specified command, chief of a military service, or commander of a major military command, that the radiocommunication system is so critical to protection of life and property that it requires continued uninterrupted operation.

7. The TSP-R reflects a department or agency's determination of the importance of a particular portion of the radio spectrum used in support of its national security and emergency preparedness functions. The TSP-R is not an index of absolute priority among potentially competing users because the missions or functions supported by a radiocommunication system may change under varying circumstances. When an actual or potential conflict in radio spectrum-use occurs, the entities directly involved should attempt to resolve the conflict with the assistance from the FAS as required. Ultimately, the OSM Associate Administrator is responsible for resolving conflicts for competing spectrum. The Associate Administrator will take into account the respective mission or functional priorities supported by the entities in conflict, and if needed seek the advice of the IRAC.

## **12.16 ADMINISTRATION OF THE TELECOMMUNICATIONS SERVICE PRIORITY FOR RADIOCOMMUNICATIONS SYSTEM**

1. The Associate Administrator (OSM) is charged with the administration of a system of radio spectrum priorities for those spectrum dependent telecommunications resources belonging to and operated by the Federal Government. The EPS will assist the OSM Associate Administrator by reviewing all NTIA certified spectrum-dependent systems that support NS/EP functions by assigning an appropriate TSP-R. The assigned TSP-R for each Federal Government spectrum-dependent systems supporting an NS/EP system will be reviewed and certified by the OSM Associate Administrator.

2. TSP-R Conflicts. A TSP-R conflict occurs when two or more NS/EP systems, that operate in overlapping spectrum at the same location, have the same TSP-R, or when there is a disagreement between IRAC member agencies regarding the priority assigned to a particular NS/EP spectrum-dependent system.

3. Resolution of TSP-R Conflicts. Conflicts regarding the assignment of a TSP-R made by the EPS that cannot be resolved at the subcommittee level will be forwarded to the IRAC for resolution. The IRAC will consider the assigned TSP-R, the function of the NS/EP system, and attempt to resolve the conflict. The IRAC will forward any unresolved conflicts to the NTIA OSM Deputy Associate Administrator for Spectrum Management, who resolves them or refers them to the OSM Associate Administrator and if necessary to the NTIA Administrator for decision. The OSM Associate Administrator will notify the agency of the final resolution.

## 12.17 NS/EP TSP-R PRIORITY LEVELS, SUBCATEGORIES, AND CRITERIA

### 1. Essential Priority 1 (E-1) NS/EP TSP-R subcategories and criteria are:

a. **National Security Leadership.** This subcategory will be strictly limited to only those radiocommunication systems essential to national survival. Systems in this subcategory are those for which a service interruption of even a few minutes would have serious adverse impact upon the supported NS/EP function.

b. **Criteria:** To qualify under this subcategory, a radiocommunication system must be at least one of the following:

- (1) Subcategory E-1 (I): Critical orderwire, or control systems supporting other NS/EP functions;
- (2) Subcategory E-1 (II): Presidential radiocommunications critical to continuity of government and national leadership during crisis situations;
- (3) Subcategory E-1 (III): National Command Authority radiocommunications for military command and control critical to national survival;
- (4) Subcategory E-1 (IV): Intelligence radiocommunications critical to warning of potentially catastrophic attack;
- (5) Subcategory E-1 (V): Radiocommunications supporting the conduct of diplomatic negotiations critical to arresting or limiting hostilities.

### 2. Essential Priority 2 (E-2) NS/EP TSP-R subcategories and criteria are:

a. **National Security Posture and U.S. Population Attack Warning.** This subcategory covers those minimum additional radiocommunication systems essential to maintaining an optimum defense, diplomatic, continuity-of-government posture. Such situations are those ranging from national emergencies to international crises, including nuclear attack. Systems in this subcategory are those for which an interruption ranging from a few minutes to one day would have serious adverse impact upon the supported NS/EP function.

b. **Criteria:** To qualify under this subcategory, a radiocommunication system must support at least one of the following NS/EP functions:

- (1) Subcategory E-2(I): Threat assessment and attack warning;
- (2) Subcategory E-2(II): Conduct of diplomacy;
- (3) Subcategory E-2(III): Collection, processing, and dissemination of intelligence;
- (4) Subcategory E-2(IV): Command and control of military forces;
- (5) Subcategory E-2(V): Military mobilization;
- (6) Subcategory E-2(VI): Continuity of the Federal Government before, during, and after crisis situations;
- (7) Subcategory E-2(VII): Continuity of state and local government functions supporting the Federal Government during and after national emergencies;
- (8) Subcategory E-2(VIII): Recovery of critical national functions after crisis situations;
- (9) Subcategory E-2(IX): National space operations.

### 3. Essential Priority 3 (E-3) NS/EP TSP-R subcategories and criteria are:

a. **Public Health, Safety and Maintenance of Law and Order.** This subcategory covers the minimum number of radiocommunication systems necessary for giving civil alert to the U.S. population and maintaining law and order and the health and safety of the U.S. population in times of any national, regional or serious local emergency. These systems and services are those for which an interruption ranging from a few minutes to one day would have serious adverse impact upon the supported NS/EP functions.

b. **Criteria:** To qualify under this subcategory, a radiocommunication system must support at least one of the following NS/EP functions:

- (1) Subcategory E-3(I): Population warning (other than attack warning);
- (2) Subcategory E-3(II): Law enforcement;
- (3) Subcategory E-3(III): Continuity of critical state and local government functions (other than support of the Federal Government during and after national emergencies);
- (4) Subcategory E-3(IV): Hospitals and distribution of medical supplies;
- (5) Subcategory E-3(V): Critical logistic functions and public utility services;
- (6) Subcategory E-3(VI): Civil air traffic control;
- (7) Subcategory E-3(VII): Military assistance to civil authorities;
- (8) Subcategory E-3(VIII): Defense and protection of critical industrial facilities;
- (9) Subcategory E-3(IX): Critical weather services;
- (10) Subcategory E-3(X): Transportation to accomplish the foregoing NS/EP functions.

4. Essential Priority 4 (E-4) NS/EP TSP-R subcategories and criteria are:

a. **Public Welfare and Maintenance of National Economic Posture.** This subcategory covers the minimum number of radiocommunication systems necessary for maintaining the public welfare and national economic posture during any national or regional emergency. These systems and services are those for which a service interruption ranging from a few minutes to one day would have serious adverse impact upon the supported NS/EP function.

b. **Criteria:** To qualify under this subcategory, a radiocommunication system must support NS/EP functions relative to at least one of the following national critical infrastructures:

- (1) Subcategory E-4(I): Distribution of food or other essential supplies;
- (2) Subcategory E-4(II): Maintenance of national monetary, credit, and financial systems;
- (3) Subcategory E-4(III): Maintenance of price, wage, rent, and salary stabilization, and consumer rationing programs;
- (4) Subcategory E-4(IV): Control of production and distribution of strategic materials and energy supplies;
- (5) Subcategory E-4(V): Prevention and control of environmental hazards or damage;
- (6) Subcategory E-4(VI): Transportation to accomplish the foregoing NS/EP functions;

5. Essential Priority 5 (E-5) NS/EP TSP-R subcategories and criteria are:

a. **National Security and Emergency Preparedness (NS/EP) Support Posture.** Unlicensed devices under certain emergency situations may require protection when linked to Federal Government system carrying a TSP-R. This subcategory covers those radiocommunication systems involved in supporting NS/EP functions necessary to accomplish a national security or war emergency but do not qualify for a higher priority. These spectrum dependent systems are those for which an interruption of one day or longer would have serious adverse impact upon the supported NS/EP function.

b. **Criteria:** To qualify under this subcategory, a radiocommunication system must support at least one of the following NS/EP functions.

- (1) Subcategory E-5(I): Training or mobilization of military personnel;
- (2) Subcategory E-5(II): Logistical support of military forces, national security, or critical national infrastructures.

## 12.18 LIMITATIONS

1. Priority levels will be assigned only to the minimum number of telecommunications services required to support an NS/EP function. Priority levels will not normally be assigned to back-up services on a continuing basis, absent additional justification (e.g., a service user specifies a requirement for physically diverse routing or contracts for additional continuity-of-service features).

2. Priority levels will not normally be assigned to experimental, back-up or redundant systems on a continuing basis without justification.

## 12.19 SUBMITTING AGENCIES RESPONSIBILITIES

1. All Federal Government telecommunications spectrum-dependent systems or subsystems supporting a NS/EP function will submit those systems to the Spectrum Planning Subcommittee (SPS) for review. A telecommunication subsystem, for the purpose of this procedure, is a combination of facilities, stations, or circuits intended to provide telecommunication support to a broader functional telecommunication entity. A statement on the agency cover letter requesting the review as to whether the proposed system or subsystem, if it becomes operational, will support an NS/EP function is required. Requests for spectrum support will contain information sufficient to enable NTIA and the SPS to evaluate systems for spectrum supportability. The information necessary to support the system review process is contained in Sections 10.8.1 through 10.8.8. Agencies will ensure that all systems supporting a NS/EP function have the NS/EP field checked in their Equipment Location – Certification Information Database (EL-CID) submission.

2. Federal agency system(s) at Stage 2 (Experimental) and Stage 3 (Developmental) that are marked for NS/EP use, will receive an ERP number and placed on an EPS Agenda, but will be noted. Once a system(s) has received Stage 4 (Operational) approval by the SPS and the certification is signed by the OSM Deputy Associate Administrator for Spectrum, the system(s) are placed on the next EPS agenda for an application for TSP-R to be submitted.

3. Federal agencies shall provide sufficient data to allow determination of operation/mission and appropriate

TSP-R. Multi-band or multi-use systems may require multiple TSP-R assignments for the radio communication system.

4. Submit all applications electronically to NTIA, IRAC Support Division, via classified systems in a format compatible with the OSM data dictionary (OSMDD).

## **12.20 EMERGENCY PLANNING SUBCOMMITTEE**

1. The EPS TSP-R review is a procedure to develop a recommendation on behalf of the IRAC for the Associate Administrator for the (OSM) regarding the appropriateness of the department or agency selected TSP-R.

2. Following the NTIA certification of spectrum support of a system or subsystem, the EPS shall:

a. Take note of the (TSP-R) for radio communications as determined by a department or agency for each of its systems supporting NS/EP functions approved under the provisions of this chapter.

b. Consider the operation/mission, the telecommunication system or subsystem and the priority designated by the department or agency in relation to the NS/EP function. Consideration of a department or agency designated TSP-R is intended only to ensure consistency of TSP-R criteria interpretation.

c. Forward any disagreements with a department or agency designated TSP-R to the IRAC for resolution.

d. Prepare a recommendation for approval to the Associate Administrator (OSM) for each system or subsystem reviewed by the EPS stating that the department or agency designated TSP-R meets the TSP-R criteria.

## **12.21 NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION**

The Associate Administrator (OSM) will:

a. Review all unresolved disagreements with a department or agency designated TSP-R forwarded by the IRAC.

b. Determine the best means of reconciliation and notify the the department or agency of this determination then note the decision in the NTIA Emergency Readiness Plan for Use of the Radio Spectrum (ERP).

c. Review the information submitted by the EPS and if appropriate certify the assigned TSP-R associated with the NS/EP system or subsystem.

d. Annotate the NTIA ERP.

**(Last Page in Chapter 12)**



## Annex A

### Record Notes

#### A.1 Coordination Notes

**C002**--Subject to coordination with the Western Area Frequency Coordinator located at the Naval Air Warfare Center, Weapons Division, China Lake, CA, prior to use within a 322-kilometer radius of Pt. Mugu or in California south of Latitude 37 30' North.

**C003**--This frequency assignment in one of the bands 1435-1525 and 2360-2395 MHz was coordinated prior to authorization with the Western Area Frequency Coordinator (WAFC) who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the WAFC as necessary to ensure compatibility with existing uses.

**C004**--Subject to coordination with the Eastern Area Frequency Coordinator located at Patrick AFB, FL, prior to use within the area bounded by 24 N 31 30'N and 77 W 83 W.

**C005**--This frequency assignment in one of the bands 1435-1525 and 2360-2395 MHz was coordinated prior to authorization with the Eastern Area Frequency Coordinator, Patrick AFB, FL, who also coordinated it, as appropriate, with Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the Eastern AFC, Patrick AFB, FL, as necessary to ensure compatibility with existing uses.

**C006**--Subject to coordination with the Area Frequency Coordinator located at White Sands Missile Range, NM, prior to use in the State of New Mexico or other U.S. territory within a 240-kilometer radius of WSMR plus the area of Utah and Colorado that lies south of 41 North and between 108 and 111 West; Telephone 505-678-5417 or 3702, DSN: 258-5417 or 3702.

**C007**--This frequency assignment in one of the bands 1435-1525 and 2360-2395 MHz was coordinated prior to authorization with the Area Frequency Coordinator, WSMR, NM, who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the AFC, WSMR, NM, as necessary to ensure compatibility with the existing uses.

**C008**--Subject to coordination with the DOD Area Frequency Coordinator located at Ft. Huachuca, AZ, prior to activation within the State of Arizona, Attn: SFIS-FAC-SH, Ft. Huachuca, AZ 85613-5000; Telephone 520-538-6423; FAX 520-538-8525; DSN 879-6423.

**C009**--This frequency assignment in one of the bands 1435-1525 and 2360-2395 MHz was coordinated prior to authorization with the Area Frequency Coordinator, Ft. Huachuca, AZ, who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the AFC, Ft. Huachuca, as necessary to ensure compatibility with existing uses.

**C010**--Subject to coordination with the Gulf Area Frequency Coordinator located at Eglin AFB, FL, prior to use within the area bounded by 24 N 33 30'N and 83 W 90 W.

**C011**--This frequency assignment in one of the bands 1435-1525 and 2360-2395 MHz was coordinated prior to authorization with the Gulf Area Frequency Coordinator, Eglin AFB, FL, who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the Gulf AFC, Eglin AFB, FL, as necessary to ensure compatibility with existing uses.

**C012**--Subject to coordination with the Joint Frequency Management Office located at the Commander-in-Chief, Pacific Headquarters, Camp H. M. Smith, HI, prior to use with the area enclosed by 322-kilometer radius of Honolulu, HI.

**C013**--Subject to local coordination with Frequency Manager, Air Force Test Center (AFFTC), Edwards AFB, CA.

**C015**--Subject to prior coordination with Frequency Manager, 30<sup>th</sup> Space Wing, Vandenberg AFB, CA.

**C016**--This frequency assignment in one of the bands 1435-1525 and 2360-2395 MHz was coordinated prior to authorization with the Air Force Spectrum Management Office, Fort Meade, MD, who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the Air Force Spectrum Management Office, Fort Meade, MD, as necessary to ensure compatibility with existing uses.

**C019**--Subject to prior coordination with Army Frequency Management Office U.S. and Possessions (AFMO US&P), 2350 Stanley Road, Suite 32, JBSA Ft. Sam Houston, TX 78234-2720; Telephone 210-221-2050/0454.

**C022**--Subject to prior coordination with Frequency Manager, Army Missile Command, Huntsville, AL.

**C024**--This frequency assignment in one of the bands 1435-1525, and 2360-2395 MHz was coordinated prior to its authorization with AFMO US&P, Ft. Sam Houston, TX, who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with AFMO US&P, Ft. Sam Houston, TX, as necessary to ensure compatibility with existing uses.

**C027**--Subject to prior coordination with DOE Area Frequency Coordinator, Las Vegas, NV, when used within the State of Nevada or within a 160-kilometer radius of Mercury or Tonopah, NV; Telephone 702-295-4766 or 0988, or 702-295-0311 (weekends, holidays, and off-duty hours).

**C030**--The Department of Commerce is designated as control for federal use of this frequency. Use under this assignment is subject to initial coordination with, and subsequent coordination as indicated by, Radio Frequency Coordinator S.I.G. Research Facilities Center, NOAA, Department of Commerce, P.O. Box 520197, Miami, FL 33152; Telephone 305-526-2936 (FTS 350-2936).

**C052**--Subject to local coordination with FCC Chief of Spectrum Coordination Branch to avoid interference to non-federal services.

**C057**-- Subject to prior coordination with NASA Spectrum Manager, Johnson Space Center, Houston, TX; Telephone 281-483-0124.

**C060**--Prior to operational use, this frequency assignment must be coordinated with and concurred by the commander of the military installation listed.

**C061**--Operational use of this frequency assignment has been coordinated with and concurred by the commander of the military installation listed.

**C062**--DOE use of this frequency for telemetering is subject to prior coordination at the national level with agencies having assignments in the same band and will be subject, at the time of such coordination, to adjustment to preclude harmful interference.

**C065**--Subject to coordination, prior to use, with the Department of the Interior, Bureau of Land Management, National Interagency Fire Center, Boise, ID; Telephone 208-387-5644.

**C067**--Subject to coordination with the Area Frequency Coordinator located at Nellis AFB, NV, prior to use in the states of Nevada, Utah west of 111 W and Idaho south of 44 N.

**C068**--This frequency assignment in one of the bands 1435-1525, and 2360-2395 MHz was coordinated prior to authorization with the Area Frequency Coordinator, Nellis AFB, NV, who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the AFC as necessary to ensure compatibility with existing uses.

**C069**-- This frequency assignment for a GOES DCP uplink is registered with the Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) office of National Environmental Satellite Data Information Service

(NESDIS) as outlined in 8.3.7 Coordination of Geostationary Operational Environmental Satellite Terrestrial Data Collection Platforms (DCP)

**C073**--Subject to prior coordination with NASA Spectrum Manager, Wallops Flight Facility, Wallops Island, VA; Telephone 757-824-1623.

**C074**--Operational activities should be coordinated with NASA Spectrum Manager responsible for JPL/Goldstone Programs. Mail: 4800 Oak Grove Drive, Mail Stop 303-404, Pasadena, CA 91109; Telephone (FTS) 8-792-0068 or (commercial) 818-354-0068.

**C075**--This assignment has been coordinated with the Hydrology Coordinator in accordance with Section 8.3.6.

**C076**--This assignment has been coordinated with the Electromagnetic Spectrum Manager, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230; E-mail: [esm@nsf.gov](mailto:esm@nsf.gov), in accordance with Section 8.3.7, for the band 1660-1670 MHz, or Section 8.3.19 of the NTIA Manual.

**C078**--The domestic fixed aspects of this assignment have been coordinated with NTIA in accordance with Section 8.2.11 of the NTIA Manual.

**C081**--This assignment is for a station in the National Radio Quiet Zone. Successful coordination has been affected in accordance with Section 8.3.9 of the NTIA Manual.

**C085**--Subject to prior coordination with Army Frequency Coordinator, Military District of Washington, Attn: ASNK-OPB, Fort Lesley J. McNair, Washington, DC 20319-5050; Telephone 202-475-2554 or 2486, DSN 335-2554 or 2486.

**C086**--This frequency assignment in one of the bands 1435-1525 and 2360-2395 MHz was coordinated prior to authorization with the Mid-Atlantic Area Frequency Coordinator, Patuxent River, MD, who also coordinated it, as appropriate, with the Aerospace and Flight Test Radio Coordinating Council. Use of this frequency under the authority of this assignment is subject to such further coordination with the AFC as necessary to ensure compatibility with existing uses.

**C088**--Prior to use, this frequency assignment must be scheduled with the Post Frequency Manager, Aberdeen Proving Ground, MD, Telephone 410-278-7591; DSN 298-7591.

**C089**--A new frequency assignment in an Aeronautical Advisory Group (AAG) (see Section 1.3.2) designated frequency band or in one of the bands 1215-1390, 2700-2900, 9000-9200 MHz (see Section 8.3.16), or a technical modification to an existing frequency assignment as defined by changes to fields described in Section 9.16.1, was coordinated with the FAA prior to submission to NTIA or Federal Communications Commission. Use of the frequency or band under the authority of this assignment is subject to further coordination with the FAA and possible modification if found necessary to ensure compatibility between all users.

**C090**--The frequency assignment in the 5091-5150 MHz for Aeronautical Mobile Telemetry (AMT) has been coordinated with the FAA prior to submission to NTIA or Federal Communications Commission, and the Aerospace & Flight Test Radio Coordinating Council. It is in accordance with US 111, and the channelization and power flux density (PFD) limits meets WRC-15 Resolution 418 and FAA requirements.

**C093**--Subject to coordination with the Area Frequency Coordinator located at the Atlantic Fleet Weapons Training Facility, Roosevelt Roads, Puerto Rico, prior to use within the area 370 kilometers of Headquarters Building, Atlantic Fleet Weapons Training Facility, Roosevelt Roads, Puerto Rico.

**C094**--Subject to coordination with the Area Frequency Coordinator located at the Naval Air Warfare Center Aircraft Division, Patuxent River, MD, prior to use within the area enclosed by 320-kilometer radius of Headquarters Building, Naval Air Warfare Center Aircraft Division, Patuxent River, MD.

**C095**--The non-military agency allotted primary use of this frequency, or which shares primary allotment status with AGA, has agreed neither Record Notes PO74 nor P076 are required for this assignment.

## **A.2 Emission Notes**

**E023**--Voice transmission is authorized for test and maintenance only.

**E028**--Lower sideband transmission. The carrier is higher than the assigned frequency shown by one half of the indicated bandwidth.<sup>1</sup>

**E029**--Upper sideband transmission. The carrier is lower than the assigned frequency shown by one half of the indicated bandwidth.<sup>1</sup>

**E030**--Lower sideband greater. The suppressed carrier is higher than the assigned frequency shown by 1.5 kHz.<sup>2</sup>

**E031**--Upper sideband greater. The suppressed carrier is lower than the assigned frequency shown by 1.5 kHz.<sup>2</sup>

**E032**--Lower sideband greater. The suppressed carrier is higher than the assigned frequency shown by .5 kHz.<sup>2</sup>

**E033**--Upper sideband greater. The suppressed carrier is lower than the assigned frequency shown by .5 kHz.<sup>2</sup>

**E035**--Lower sideband transmission.<sup>1</sup>

**E036**--Upper sideband transmission.<sup>1</sup>

**E037**--Full-carrier SSB emission (3KH3E) shall be used except (1) when it is known that the receiving station is capable of receiving suppressed-carrier emission (3KJ3E) and (2) upon request of any station using the same carrier frequency (Ref: FCC 87.67b).

**E038**--When a single sideband emission is used from the various emissions shown on this HF assignment, the carrier frequency will be set to place the center of intelligence at the assigned frequency.

**E039**--The authorized emission bandwidth shall be so located within the band that it does not extend beyond the upper or lower limits of the authorized band shown in the \*FRB entry of circuit remarks. If a portion(s) of the authorized band is to be excluded (\*FBE) the authorized emission bandwidth must not extend into any portion(s) of the excluded band(s).

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<sup>1</sup> Applies to SSB transmission.

<sup>2</sup> Applies to two or more independent sideband channels.

### **A.3 Limitation Notes**

**L2**--Restricted to (daytime, nighttime, or indicated hours of operation.) Wherever used herein the term daytime means from two hours after local sunrise until two hours before local sunset. The term nighttime only means from two hours prior to local sunset until two hours after local sunrise at (a) specified point(s). Local time at transmitter is applicable unless otherwise specified.

**L3**--For communication with \_\_\_\_\_ stations only.

**L012**--To be used only in an emergency jeopardizing life, public safety, or important property under conditions calling for immediate communication where other means of communication do not exist or are temporarily disrupted or inadequate. To ensure that radio equipment for emergency use is maintained in satisfactory operating condition, testing on such frequencies is permitted, provided that insofar as practicable, transmitters shall be tested with a non-radiating load and the test use of a radiating antenna held to a minimum and provided further that such testing shall be restricted to test message traffic and shall not include operator training.

**L113**--L012 FX

**L116**--L2 daytime

**L121**--L2 daytime Hawaii and westward

**L125**--L2 local sunrise to local sunset

**L131**--L2 nighttime

**L171**--L3 Agriculture

**L180**--L3 Coast Guard

**L182**--L3 Interior

**L187**--L3 Military

**L188**--L3 Military aircraft or aircraft authorized for military use

**L190**--L3 Navy

**L192**--L3 non-federal

**L195**--L3 non-federal coast stations

**L197**--L3 non-federal public correspondence

**L199**--L3 non-federal ships

**L203**--L3 U.S. Army Engineers

**L282**--This assignment is for "back-up" use only when regular channels are either temporarily disrupted or inadequate.

**L283**--Limited to communications in or near a port, or in locks or waterways, between coast stations and ship stations, or between ship stations, in which messages are restricted to those related to the operational handling, the movement and the safety of ships, and, in emergency, to the safety of persons. Messages which are of a public correspondence nature shall be excluded.

**L308**--L3 Commerce

**L318**--Authority under this assignment is limited to temporary periods and locations for telemetry of seismic data.

**L330**--This assignment is limited to communications with non-federal ships for the exchange of traffic dealing with safety of life or property when other means of communication are not practicable.

**L341**--Limited to operations conducted in accordance with Bridge-to-Bridge portion of Section 8.2.29 of the NTIA Manual.

**L347**--L2 2330-2230 GMT

**L350**--Limited to use from November 15 to April 1.

**L355**--Limited to ground transmissions only.

**L357**--This band assignment is authorized only for air/ground frequency assignment in the AAG/MAG bands (118-137 MHz and those frequencies utilized by the FAA for air traffic control in the 225-328.6 and 335.4-400 MHz band) and is for "back-up" use only when regular channels are either temporarily disrupted or inadequate. Actual frequencies will be listed in Agency Remarks.

**L358**--L2 1300-2200 GMT.

## A.4 Minute Notes

Do NOT enter minute notes “M” in the NTS field. “M” notes are to be entered on an \*NTS line in the CIRCUIT REMARKS field (see Section 9.8.2, paragraph 39k).

**M001**--A note concerning this assignment is recorded in the minutes of the FAS meeting at which the application was approved. The source of the note is identified in the CIRCUIT REMARKS field (\*NTS).

**M002**--This assignment was coordinated with IRAC or NTIA, and/or is subject to the conditions stated in the letter, the IRAC Document, the FAS Docket, or the FCC Regulation referenced in the CIRCUIT REMARKS field (\*NTS).

**M003**--Subject to coordination prior to activation and, as appropriate, possible scheduling with the activity(ies) or station(s) listed in the CIRCUIT REMARKS field (\*NTS).

**M004**--Subject to coordination prior to activation and, as appropriate, possible scheduling with the activity(ies) listed in the CIRCUIT REMARKS field (\*NTS) when used within interference range of such activity(ies) or station(s).

**M006**--Subject to coordination prior to activation with the National Weather Service Meteorologist-In-Charge at the location(s) listed in the CIRCUIT REMARKS field (\*NTS).

**M007**--Subject to notification of activation to the agency or activity listed in the CIRCUIT REMARKS field (\*NTS).

**M008**--Operations under the authority of this assignment are subject to immediate adjustment, including cessation, if they result in harmful interference to the operations listed in the CIRCUIT REMARKS field (\*NTS).

**M009**--Operations under the authority of this assignment a) are on a noninterference basis to the operations of the agency listed in the CIRCUIT REMARKS field (\*NTS) on the same or adjacent channel and b) no protection can be afforded by that agency.

**M010**--This assignment was agreed to on a nonrenewable basis by the agency identified in the CIRCUIT REMARKS field (\*NTS).

**M011**--Limited to the non-broadcast hours of and subject to coordination prior to activation with the station(s) listed in the CIRCUIT REMARKS field (\*NTS).

**M013**--Subject to prior coordination with and concurrence by the organization/official listed in the CIRCUIT REMARKS field (\*NTS) and to temporary cessation when required for marine environmental operations.

**M014**--During transmission, aircraft shall not exceed the altitude listed in the CIRCUIT REMARKS field (\*NTS).

**M015**--The system using this assignment was reviewed by the SPS in accordance with Chapter 10 and the assignment is being made subject to conditions stated in the IRAC and SPS documents referenced in the CIRCUIT REMARKS field (\*NTS).

**M017**--This non-federal space station assignment is made with the understanding that protection cannot be guaranteed to reception of the non-federal earth station(s) identified in the CIRCUIT REMARKS field (\*NTS) due to the operation of existing transmitting earth stations and/or federal fixed stations.

**M018**--When a frequency application has been pre-coordinated between two agencies prior to the application being submitted to the FAS use this CIRCUIT REMARKS field (\*NTS) to indicate agency, person, date, and limitations/reference. (optional)

## A.5 Priority Notes

**P032**--Noninterference basis

**P074**--Not to preclude expansion and adjustment of operations within the band 162.0 to 174.0 MHz by non-military federal agencies.

**P076**--Not to preclude expansion and adjustment of operations within the band 406.1 to 420.0 MHz by non-military federal agencies.

**P077**--This assignment supports a transportable fixed application, and as such, the antennas used may not fully comply with the fixed antenna performance standards specified in Section 5.3.3.3 Antenna Standards of the NTIA Manual. Every effort to comply with manual standards will be employed as new technology, system upgrades and/or mission requirements allow. This assignment will operate in accordance with SPS certification guidance.

## A.6 Special Notes

**S012**--This operation does not include operator qualification training, but is a periodic operation of a communications system manned by fully qualified operators who are military reservists or affiliates. Except in emergencies, this frequency assignment will not be used as a means for passing traffic that in the absence of this authorization would require delivery by other means.

**S015**--Remote control

**S017**--This assignment is for the training of personnel in the technique and operational aspects of the electronic equipment.

**S032**--Common simplex channel for emergency and distress communications only. Available to all stations operating in or with aeronautical services.

**S034**--Disaster communications

**S035**--Distress, safety and calling

**S038**--FAC operation simultaneous with RLL

**S041**--For calibrating direction finders

**S043**--For emergency use at scene of air sea rescue

**S047**--For transmission of hydrologic and meteorological data

**S048**--For transmission of hydrologic data

**S059**--Radio direction finding

**S063**--Search and rescue communications

**S067**--Subject to Department to the Interior, Bureau of Indian Affairs net control

**S068**--Subject to immediate shutdown as needs of service may dictate

**S070**--Subject to immediate cancellation upon notice from FCC

**S085**--Training and testing operations

**S120**--Intermittent equipment tests

**S139**--Transmissions on this frequency will be discontinued upon receipt of notification to the effect that harmful interference is being caused to the international broadcasting service.

**S141**--This U.S. Government record is outside of the US&P and therefore does not fall within the jurisdiction of the NTIA and IRAC/FAS. This record is incorporated into the Government Master File for spectrum management, analysis and information purposes and does not constitute NTIA authority to transmit.

**S142**--Drone Control

**S144**--This assignment is not in complete conformity with the National Table of Frequency Allocations. Those operations that are conducted under the non-conforming portions of this assignment are on a secondary basis to operations conducted under assignments that are in conformity with the National Table of Frequency Allocations.

**S145**--This frequency is subject to adjustment upon notice from the military.

**S147**--These frequencies are used for a very short time only during actual nuclear test or dry runs prior to actual test. Such use of frequencies will be on a secondary basis subject to the avoidance of harmful interference to all operations established in accordance with international allocations applicable to these frequencies and to all other operations regularly authorized within the United States and Possessions on specific frequencies within these bands.

**S148**--This is an assignment for domestic service use in providing instantaneous transmission of vital emergency, operational command and alerting traffic of such importance as to affect the immediate survival and defense of the Nation. Circuits utilizing this frequency will be maintained in an operational status at all times, with on-the-air test transmissions to ensure the highest degree of readiness. This assignment requires protection commensurate with the importance of the communications for which the circuit is intended.

**S149**--Any use of this assignment that is not at a transient location or that is for a period exceeding 15 days shall be notified to the FAS.

**S150**--This assignment is for a frequency that has been allotted for the primary use of another agency or for all government agencies (AGA); or, the emission bandwidth overlaps a frequency or frequencies allotted for primary use by another agency or all government agencies (AGA). If the frequency is allotted to another agency, the operations on this frequency must be moved to a properly allotted frequency, unless the agency to which the frequency is allotted agrees to the continued use of their allotted frequency. If the frequency is allotted for AGA and there are available frequencies allotted to the agency for its primary use, this operation should be moved to a frequency allotted primarily to the agency. The transition from this frequency in the 406.1-420 MHz band is in accordance with the provisions outlined in section 4.3.9 of the NTIA Manual.

**S151**--This assignment must be narrowbanded in accordance with either Section 4.3.7, 4.3.9, or 5.3.5.2 of the NTIA Manual.

**S154**--Scene of disaster frequency.

**S155**--For interception and retransmission of television signals.

**S157**--Non-federal service

**S159**--U.S. Government short-distance low-power service

**S160**--This assignment has been made pursuant to Section 7.12 of the NTIA Manual and has been coordinated in accordance with Section 8.3.3.

**S164**--This assignment is not in complete conformity with the National Table of Frequency Allocations. Nevertheless, in the national interest, it is on an equal basis with assignments that are in conformity with the National Table of Frequency Allocations.

**S165**--This assignment has been made pursuant to Section 7.5.2 of the NTIA Manual for communication with non-federal stations in the maritime mobile service.

**S170**--Authorized additionally in tactical and training operations when employing single sideband equipment with 3KH3E, 4KJ7B, 4KJ9W emissions for use with peak envelope powers not to exceed 2000 watts. In such operations the following additional conditions are applicable. All necessary emissions under the several modes of operation, including reduced carriers, shall be within kHz of the listed frequency. If harmful interference is caused to authorized operations, the power of this operation will be reduced to the mean power shown for this listing. In the determination of particular listed frequencies and associated carrier frequencies to meet individual tactical needs, due consideration will be given, particularly when utilizing powers in excess of the powers normally authorized on this frequency, to the avoidance of harmful interference to radio services authorized on the same or adjacent frequencies. With respect to the conduct of peacetime training operations, such use of the frequency is on a non-interference basis to the authorized operations of other agencies.

**S171**--Authorized additionally in tactical and training operations when employing single sideband equipment with 3KH3E, 4KJ7B, 4KJ9W emissions for use with peak envelope powers not to exceed 400 watts. In such operations the following additional conditions are applicable. All necessary emissions under the several modes of operation, including reduced carriers, shall be within kHz of the listed frequency. If harmful interference is caused to authorized operations, the power of this operation will be reduced to the mean power shown for this listing. In the determination of particular listed frequencies and associated carrier frequencies to meet individual tactical needs, due consideration will be given, particularly when utilizing powers in excess of the powers normally authorized on this frequency, to the avoidance of harmful interference to radio services authorized on the same or adjacent frequencies. With respect to the conduct of peacetime training operations, such use of the frequency is on a non-interference basis to the authorized operations of other agencies.

**S179**--Power shown is for emergencies only. Normal power is 4 kW or less.

**S181**--This assignment was authorized pursuant to Public Law 87-795.

**S185**--Secondary service. Maximum number of transmitters authorized: 10

**S186**--Power shown is for intermittent or emergency use. Normal power is 20 kW.

**S189**--Tactical and/or training operations

**S195**--Safety Communications

**S196**--This assignment is for range safety (command destruct/flight termination) in the band 406.1-420 MHz and is authorized in accordance with Section 8.2.54 of the NTIA Manual with an expiration date not to exceed December 31, 2014.

**S199**--Navy operations authorized by assignments bearing this note shall not cause harmful interference to those non-federal operations existing at the time of authorization. The Navy agrees to make such adjustments of its group of high frequency coast telegraph assignments bearing this note as may be necessary to accommodate necessary expansion or adjustment of the non-federal coast telegraph service.

**S200**--JCS communication circuit

**S205**--Civil defense network

**S206**--This assignment is for an operation for which other telecommunication facilities do not exist, are inadequate, or are impracticable of installation, and for which the use of frequencies above 30 MHz is not practicable. This note applies to FX or AX station classes only.

**S208**--This assignment is for the domestic haul of overseas traffic in transit or destined for the United States, for an operation where technical and operational requirements dictate such use. The domestic radio haul is a segment of the overall overseas radio system.

**S211**--50 kW mean power used during emergency or unusually poor propagation conditions. 10 kW mean power used during normal conditions. 2.5 kW mean power used during unusually good propagation conditions.

**S219**--Power shown is for emergency use. Normal power is 3 kW.

**S227**--Power shown is for emergency use. Normal power is 1.5 kW.

**S233**--This assignment is part of a frequency pool, and, with Department of State approval, it may be used by foreign embassies that are authorized the use of other frequency assignments under Public Law 87-795.

**S242**--The NASA Unified S-band system operates in the 2270-2290 MHz portion of the 2200-2290 MHz space telemetering band on a shared basis. This system will be utilized in space missions of extended duration. In certain geographical areas agencies conducting telemetering operations on the shared frequencies in the 2270-2290 MHz band may be requested by NASA to adjust such operations as necessary to support the space mission involved.

**S264**--This assignment will not be used except in the event that full-scale atmospheric nuclear testing is resumed, and it is further subject to prior coordination with PACOM.

**S267**--Required for use in emergency areas when required to make initial contact with RACES units. Also, for communications with RACES stations on matters requiring coordination.

**S279**--This listing represents a use of a laser(s) for telecommunication purposes, and it is entered in the Government Master File (GMF) for information.

**S286**--The Coast Guard agrees to make such adjustments in its coast telegraph operations as necessary to provide an accommodation for non-federal coast radiotelegraph operations anticipated by the designation of this frequency in Part 81, FCC Rules.

**S288**--This frequency assignment is to support the National Command Authority. Circuits utilizing this frequency will be maintained in operational status at all times.

**S291**--Operations are subject to compliance with FCC Rules and Regulations Part 87, subpart c. Advisory service shall be given to any private aircraft upon request. The use of this frequency shall not be a deterrent to the establishment of a non-federal advisory station in this area. Operations on this frequency shall cease upon the establishment of non-federal facilities or upon notice of harmful interference thereto.

**S292**--Not to be a bar to complete operational implementation of common system aids to air navigation.

**S296**--Not to preclude assignment of this frequency to other agencies at specific locations.

**S297**--This assignment is part of the Wide-area Multi-user Land Mobile Justice Wireless Network certified by NTIA in IRAC Doc. 31594. The provisions of paragraphs 3 through 5 of Section 8.2.48A of the NTIA Manual, except for the provisions of Paragraph 3 of that Section that require each agency to conduct requirements analysis of need and to conduct an analysis of alternatives to operating their own system, are waived for this assignment.

**S298**--Subject to Department of the Interior, U.S. Fish and Wildlife Service net control.

**S299**--Power shown is into a buried vertical dipole. ERP is approximately 1 kW.

**S300**--This assignment in the 162 to 174 MHz band supports the Federal Wildlife Telemetry program managed by the Department of the Interior's U.S. Fish and Wildlife Service. It is authorized on a non-interference basis and will be used for short-term periods at unspecified locations throughout the United States and possessions.

**S301**--Operations under the authority of this assignment a) are not protected from harmful interference which may be caused by authorized stations operating in accordance with the National Table of Frequency Allocations and b) are subject to immediate adjustment, including cessation, if they result in harmful interference to authorized stations operating in accordance with that table.

**S302**--Subject to the understanding that equipment will not be developed for operational use in this band.

**S303**--Subject to the understanding that there is not intended operational use of this equipment within USP.

**S319**--Federal Government use of frequencies in the 4940-4990 MHz band will be on a non interference basis to any non-federal operations and shall not hinder the implementation of any non-federal operations.

**S321**--This assignment is for planning purposes not to exceed 3 years (see Section 9.6.5). The Note will be deleted after the assignment has been activated or this assignment will be deleted after specific locations have been notified.

**S322**--Stations established under the authority of this assignment shall conform to its technical particulars and shall be notified, as specified in Section 9.1.3 of the NTIA Manual, for inclusion in the list of Frequency Assignment to Federal Radio Stations.

**S327**--Marine environmental protection command/control/surveillance operations. Authorized additionally for other maritime mobile operations when not required for marine environmental purposes.

**S328**--This assignment is not planned for renewal. It has been replaced by another assignment.

**S330**--The equipment nomenclature or appropriate equipment coding is to be provided within six months after activation of the authorized stations.

**S334**--Subject to Department of the Interior, Bureau of Land Management net control.

**S335**--This telemetry assignment is on a non-interference, non-protected basis as concerns assignments in the aeronautical mobile service.



**S340**--To be used in support of DOE scientific missions with protected status for short periods of time during actual operations. Such use will require coordination between the DOD and DOE and will be on a scheduled basis.

**S341**--Subject to the continued applicability of note P074, this WSMR assignment is exempt from the requirement to be converted to a frequency listed in Section 4.3.7 of the NTIA Manual.

**S344**--This assignment has been granted a waiver and need not comply with the provisions of Section 8.2.20 of the NTIA Manual.

**S345**--DOE operations in the band 4400-4940 MHz under this authority will be for emergency deployment of the NEST system. For such use in a given area, DOE will select clear channels based upon current GMF records. If time permits, DOE will coordinate specific frequencies with the appropriate military frequency managers/coordinators in the field. Tests and training will not be conducted under this authority; frequency applications for such operations will be submitted to the FAS/IRAC on a case-by-case basis.

**S348**--Operations are subject to compliance with FCC Rules and Regulations, Part 95, Subpart D. Transmitters may be operated only by employees of the Federal Government only for the purpose of interfacing with Non-federal licensees to coordinate essential and mutual activities. This authority may be revoked by the Federal Communications Commission in its discretion at any time.

**S349**--Not to preclude assignment of this frequency outside of normal land mobile interference range (excluding skip and sporadic E reflection etc.) of DOE receive stations.

**S350**--In the frequency band 30-400 MHz for this FAC operation, power shown is for primary equipment. Back-up equipment has been engineered and installed with output power up to 35 watts. Use of this back-up equipment is authorized during emergencies and/or failure of primary equipment.

**S351**--This assignment is planned for implementation or deletion as a consolidation of frequencies being used.

**S354**--This planned assignment is for a Space Project that has been approved in principle by NTIA in the research/development phase. Some operational characteristics have not been determined. This listing does not provide authority to transmit.

**S355**--This assignment is for a wide-area, common-use frequency pursuant to Section 4.2.3 of the NTIA Manual.

**S356**--This assignment is for a local-area, common-use frequency pursuant to Section 4.2.4 of the NTIA Manual.

**S357**--Power shown is for emergencies only. Normal power is 10 kW.

**S358**--This assignment is exempt from referral to NTIA by Exception 1 of the domestic fixed policy in Section 8.2.11 of the NTIA Manual.

**S359**--This assignment is exempt from referral to NTIA by Exception 2 of the domestic fixed policy in Section 8.2.11 of the NTIA Manual.

**S360**--This assignment is exempt from referral to NTIA by Exception 3 of the domestic fixed policy in Section 8.2.11 of the NTIA Manual.

**S361**--Multiple transmitting and/or receiving stations operating at FIXED (STC prefixed with FX) locations are involved in this assignment; and, it is not feasible to indicate all specific locations. (The method of operation must be fully explained in supplementary details when S361 is applied to a frequency assignment.)

**S362**--One or more transportable transmitting and/or receiving stations are utilized in this assignment.

**S366**--All operations will be outside of the U.S./Canada Border Zone, or for assignments for frequencies below 1000 MHz the power used while operating in the Border Zone will not exceed 5 watts.

**S367**--This frequency assignment has been made on an exceptional basis for operation in the National Radio Quiet Zone on the conditions that use shall be minimized consistent with operational requirements and that any technical modification to this assignment shall be coordinated in accordance with Section 8.3.9 of the NTIA Manual.

**S368**--Subject to Department of the Interior, Bureau of Reclamation net control.

**S370**--Transportable earth station operations in the 7300-7750 MHz and 8025-8400 MHz bands shall be deployed in such a manner as not to cause harmful interference to existing assignments and will adjust to allow additional stations of other radio services in these bands as required.

**S371**--This assignment is in accordance with Chapter 10 and Section 7.14 of the NTIA Manual.

**S373**--This assignment, in the 2700-2900 MHz band, is for operation in a designated heavily used area or for collocated operation (see Annex D of the NTIA Manual). This equipment has the capability of implementing the additional Electromagnetic Compatibility (EMC) provisions of RSEC Criteria D under Section 5.3 of the NTIA Manual. Implementation of this capability may be necessary at a later date.

**S375**--Operations authorized by assignments bearing this note shall be subject to the GMF recording method being developed in accordance with IRAC Doc. 23200/1 (FAS ADM 830029/1).

**S376**--Operations on this frequency under direct-control of the USDA, Forest Service.

**S378**--In emergency situations a maximum power of 25 watts for ship stations and 10 watts for coast stations is authorized.

**S381**--Operations under this assignment are for SHARES traffic in accordance with Section 7.3.8 of the NTIA Manual.

**S382**--This record is retained for spectrum management and analysis purposes and does not constitute an NTIA authority to transmit.

**S383**--This sounder assignment complies with Section 8.2.21 of the NTIA Manual. The frequency bands listed in paragraph 1.c. of Section 8.2.21 have been suppressed. The information required by paragraph 2 of Section 8.2.21 is provided in the supplementary details of this assignment.

**S384**--This assignment has been made pursuant to Part 4.3.2 of the NTIA Manual.

**S385**--This GMF listing identifies passive sensor or radio astronomy receiving stations for spectrum management and analysis purposes and does not constitute an NTIA authority to transmit. Interference protection to the receiving station is afforded only to the extent provided in the National Table of Frequency Allocations.

**S387**--Upon implementation of narrowband operations this channel will be vacated.

**S388**--This assignment supports DSCS Operations Center earth stations limited to locations at Fort Detrick, and Fort Meade, MD, and Camp Roberts, CA. This assignment shall not preclude new terrestrial assignments within or overlapping the frequency band 7250-7750 MHz provided each new terrestrial assignment does not exceed a maximum tolerable interfering power of -141.3 dBm in any 30 kHz bandwidth at the earth station receiver. In addition, this assignment has no priority over either future meteorological-satellite systems (See G104) or terrestrial assignments authorized prior to April 26, 1994.

**S390**--This assignment for wideband telegraphy, facsimile and/or special transmission systems in the Maritime Mobile Service is being made in accordance with Section 8.2.29, paragraph 5.c.(1) of the NTIA Manual and ITU RR 52.170.

**S391**--This assignment is an expansion or enhancement of an existing system in the 138-150.8, 162-174, or 406.1-420 MHz band which utilizes a band-width greater than 11 kHz.

**S396**--This assignment is in accordance with either Section 4.3.7, paragraph 6.a, or Section 4.3.9, paragraph 6.d of the NTIA Manual.

**S397**--This assignment is for a joint law enforcement requirement pursuant to Section 4.3.16 of this Manual.

**S398**--This assignment is for a joint incident response requirement pursuant to Section 4.3.16 of this Manual.

**S399**--Effective January 1, 2005, any federal operation in the band 162-174 MHz, not conforming to the 12.5 kHz channel plan, is on a non-interference basis to all operations that do conform to the 12.5 kHz channel plan in accordance with Section 4.3.7 of the NTIA Manual.

**S400**--This frequency assignment is delinquent for review in accordance with the NTIA Manual 8.2.6 and Annex F, and an expiration date (EXD) has been applied. The Agency will review the frequency assignment, remove the expiration date (EXD) and this S note prior to the EXD or the assignment will expire.

**S401**--This record requires review every 10 years per NTIA Manual, Annex F.

**S402**--This assignment has been made pursuant to Section 8.2.47 of the NTIA Manual for a shared federal/non-federal radio system.

**S403**--This is a temporary GMF assignment for a short-term/limited period requirement that the agency request expedited review by the FAS representatives.

**S404**--This assignment fulfills a requirement for NOAA Weather Radio Link UHF one-way single frequency operation.

**S405**--Prior to operation under the authority of this assignment for unmanned aircraft system (UAS), a certificate of waiver or authorization must be obtained from the Federal Aviation Administration per 8.3.33.

**S406**--GPS re-radiators must operate in accordance with Section 8.3.28 of the NTIA Manual. Any malfunction, misalignment, or tampering with the equipment or its location resulting in increased power spectral density outside the building could cause harmful radio frequency interference to GPS receivers, including those in aircraft or ground based facilities.

**S407**--Army Tactical Radio Relay (TRR) operations are authorized on a non-interference basis under the following conditions: (1) Until an Advanced Wireless Service (AWS) licensee successfully coordinates to operate within 115 km of the TRR area of operation; or (2) Army has coordinated successfully with all affected AWS licensees.

**S408**--The equipment is performing short-term DOD AIMS Platform Level Certification testing at a specific location not listed in the approved SPS Stage 3 Certification, not to exceed ninety days. This location shall not be used for operational or training purposes unless both the AIMS certification letter and the SPS Stage 4 has been approved.

**S409**--The equipment listed in this assignment has completed AIMS certification testing and is awaiting the official AIMS certification letter and NTIA, Stage 4 certification as required by NTIA 10.8.4(2) and 8.3.16.3(7). This assignment allows operations to proceed until NTIA, Stage 4 certification is completed. Equipment use must be

within the operational parameters authorized by the AIMS certification test.

**S545**--This assignment supports the NASA/Commerce Earth Exploration Service Space Program LANDSAT.

**S566**--This assignment shall expire upon completion of the Advanced Technology Satellite Global Positioning System space project.

**S567**--This assignment shall expire upon completion of the Deep Space Program space project.

**S570**--This assignment shall expire upon completion of FLEETSATCOM space project.

**S572**--This assignment shall expire upon completion of the Air Force Satellite Data System space project.

**S575**--This assignment supports the NASA TDRSS space program.

**S576**--This assignment supports the NASA Space SHUTTLE (STS) program.

**S594**--This assignment supports the GOES Space System.

**S595**--This assignment supports the GPS program.

**S597**--This assignment supports the Navy Space Surveillance System.

**S603**--This assignment supports the Space Ground Link Subsystem (SGLS) operations.

**S604**--This assignment supports foreign space operations.

**S606**--This assignment shall expire upon completion of the NATO IIIA space project.

**S615**--This assignment supports the FCC authorized EUTELSAT Atlantic Bird-2 satellite located at 8.0 WL.

**S617**--This assignment supports the NASA SAR space program.

**S619**--This assignment supports the INTELSAT V satellite.

**S621**--This application supports a DOD space project.

**S626**--This assignment shall expire upon completion of the LEASAT (FLTSATCOM-A) space project.

**S627**--This assignment supports the Small Business satellite.

**S629**--This assignment supports the TIROS-N space system.

**S632**--This assignment supports the NASA Voyager Deep Space Program.

**S641**--This assignment supports the NASA Hubble Space Telescope (HST) space program.

**S643**--This assignment supports the Defense Satellite Communications System (DSCS).

**S651**--This assignment supports the NASA Space Station space program.

**S662**--This assignment is for Common Carrier service provided in a non-federal Domestic Satellite System. The specific frequency and satellite is dependent upon the Common Carrier selected to provide the service.

**S664**--This assignment shall expire upon termination of the STATIONAR Satellite System (USSR).

**S665**--This assignment is in the INMARSAT space system. If this assignment is for a transportable land-based or aeronautical INMARSAT terminal, it is subject to coordination with the Common Carrier Bureau of the Federal Communications Commission. This coordination will be conducted by the Communications Satellite Corporation in accordance with Annex E.

**S666**--This assignment supports the NATO IV space project.

**S670**--This assignment supports the FCC authorized INTELSAT Satellite System.

**S671**--This assignment supports the Orbital Sciences Corporation DATASAT Space System.

**S673**--This assignment supports the NASA Space Program Cosmic Background Explorer (COBE) satellite.

**S680**--This frequency supports the Commerce project Pan-Pacific Educational and Cultural Experiments by Satellite (PEACESAT).

**S681**--This assignment supports the NASA Extra-Vehicular Activity UHF Communications Subsystem.

**S692**--This assignment supports the Motorola Satellite Communications, Inc.'s IRIDIUM Space System.

**S696**--This assignment supports the NASA Tropical Rainfall Measurement Mission (TRMM).

**S698**--This assignment will expire upon completion of the Space Project NATO IV.

**S703**--This assignment supports the NASA Summer Undergraduate Research Fellowship Satellites I and II (SURFSAT).

**S707**--This assignment supports the German SAFIR System.

**S710**--This assignment supports the MILSTAR Communications Satellite System.

**S712**--This assignment supports the DOE Proliferation Detection and Environmental Monitoring Satellite Program.

**S713**--This assignment supports the NASA Fast Auroral Snapshot Explorer (FAST).

**S714**--This assignment supports the NASA Submillimeter Wave Astronomy satellite (SWAS).

**S715**--This assignment supports the NASA International Solar Terrestrial Program (ISTP) Interplanetary Physics Laboratory WIND.

**S717**--This assignment supports the NASA Earth Observing System AM (EOS-AM) which is also known as Terra Communications System.

**S719**--This assignment supports the NASA Advanced Composition Explorer (ACE).

**S722**--This assignment supports the NASA CASSINI Satellite System.

**S723**--This assignment supports the NASA Chandra X-Ray Observatory (CXO).

**S724**--This assignment supports commercial service using the Russian LOUTCH WSDRN satellite.

**S730**--This assignment supports the NOAA K, L, and M Satellite System.

**S733**--This assignment supports the EARTHWATCH Remote Sensing System.

**S737**--This assignment supports the Hughes Communications Galaxy, Inc. GALAXY VIII (I) satellite.

**S742**--This assignment is for use by a Federal Government earth station supporting a foreign space operation. The responsible federal agency has waived the NTIA spectrum certification process for the earth station operation. Therefore, although this operation may be in accordance with the National Table of Frequency Allocations, it must be conducted on an unprotected, non-interference basis to those U.S. operations that are in conformity with the National Table of Frequency Allocations.

**S743**--This assignment shall expire upon termination of the EXPRESS Satellite System (Russia).

**S745**--This assignment supports a Federal Government space program.

**S747**--This assignment is for a receive only earth station for the IRS-1B satellite.

**S748**--This assignment is for a receive only earth station for the IRS-1C satellite.

**S749**--This assignment is for a receive only earth station for the ERS-2 satellite.

**S750**--This assignment supports the Space Test Experiment Platform (STEP 0) program.

**S758**--This assignment supports the PANAMSAT PAS-8 and PAS-9 satellites.

**S759**--This assignment supports the NASA Thermosphere-Ionosphere-Mesosphere-Energetics-Dynamics (Timed) Satellite System.

**S760**--This assignment supports the Ikonos-1 and Ikonos-2 Satellite System.

**S762**--This assignment supports the ICO Medium Orbit satellite constellation.

**S763**--This assignment supports a Federal Government program using a commercial contractor operating in the non-federal space band. The license to operate is held by a non-federal entity in support of this program. This record is incorporated into the Government Master File for spectrum analysis, and information purposes.

**S765**--This assignment supports the GLOBALSTAR Satellite System.

**S767**--This assignment supports the Orbview Space System.

**S769**--This assignment is for a receive only earth station for the IRS-1D satellite.

**S771**--This assignment supports the NASA Quikscat Satellite System.

**S775**--This assignment supports the NASA Active Cavity Radiometer Irradiance Monitor Satellite System (ACRIMSAT).

**S780**--This assignment supports the NASA Earth Orbiter-1 (EO-1) Communications System.

**S782**--This assignment supports the NASA Earth Observation System-PM (EOS-PM), which is also known as Aqua.

**S783**--This assignment supports the NAHUEL-C Satellite System (Argentina).

**S785**--This assignment supports the NASA Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) Communications System.

**S786**--This assignment supports the NASA Galaxy Evolution Explorer (GALEX) Satellite Communications System.

**S787**--This assignment supports the NASA Ice, Cloud, and Land Elevation (ICESAT) Satellite Communications System.

**S788**--This assignment supports the NASA Spitzer Space Telescope (formerly the Space Infrared Telescope Facility (SIRTF)) Communications System.

**S789**--This assignment supports the FCC Galaxy-11 Satellite System.

**S791**--This assignment supports the NASA 2001 Mars Odyssey (formerly Mars Surveyor 2001 Orbiter) Communications System.

**S792**--This assignment supports the NASA Wire-less Video System (WVS) Communications System.

**S795**--This assignment supports the HISPASAT-1C Satellite System.

**S796**--This assignment supports the Astrovision Satellite System.

**S797**--This assignment supports the NASA Solar Radiation and Climate Experiment (SORCE) Satellite Communications System.

**S799**--This assignment supports the NASA Swift Gamma Ray Medium Class Experiment (MIDEX) Satellite Communications System.

**S802**--This assignment supports the FCC authorized AMC-4 (formerly GE-4) Satellite System.

**S804**--This assignment supports the PANAMSAT PAS-5 Satellite System.

**S805**--This assignment supports the PANAMSAT PAS-1R Satellite System.

**S806**--This assignment supports the NASA Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) (formerly PICASSO) Satellite Communications System.

**S812**--This assignment supports the NASA Earth Observing System (EOS) - Aura Satellite Communications System.

**S814**--This assignment supports the Atlantic Bird 2 (EUTELSAT) at 8.0 WL Satellite System.

**S816**--In the band 3600-3650 MHz, in accordance with US245,

i) an EMC analysis based on the NTIA TR-99-361 report was performed by the non-federal applicant and the non-federal applicant agrees to accept this potential for unacceptable interference; and

ii) these fixed-satellite service operations are limited to international inter-continental systems.

**S817**--In the band 3650-3700 MHz, in accordance with US348, an EMC analysis based on the NTIA TR-99-361 Report was performed by the non-federal applicant and the non-federal applicant agrees to accept this potential for unacceptable interference from the three stations identified in US348. Additionally, per US245, in the band 3650-3700 MHz, these fixed-satellite service operations are limited to international inter-continental systems.

**S818**--The band 5850-5925 MHz is shared on a co-primary basis with Federal Government radiolocation systems in the U.S. and Possessions. In accordance with US245,

i) the applicant is aware of the potential allocation and electromagnetic compatibility issues in the 5850-5925 MHz frequency band and the applicant agrees to accept this potential for unacceptable interference from radiolocation stations operating in accordance with footnote G2 and,

ii) these fixed-satellite service operations are limited to international inter-continental satellite systems.

**S819**--In the U.S. and Possessions, the band 5850-5925 MHz is shared on a co-primary basis with federal radiolocation systems. In accordance with US245, this earth station transmitter has been successfully coordinated with the Federal Government. The federal operators have evaluated the potential interference from this earth station transmitter to their radiolocation receivers and have concluded that no unacceptable interference will occur. Any conditions placed on the earth station transmitter are included in SUPPLEMENTARY DETAILS. Any conditions required to protect radiolocation receivers will also be included in the FCC license.

**S820**--This assignment supports the FCC authorized New Skies Satellite System.

**S821**--This assignment supports the NASA Mercury Surface Space Environment, Geochemistry and Ranging (MESSENGER) Satellite Communications System.

**S823**--This assignment supports the FCC authorized TELSTAR-6 Satellite System.

**S824**--This assignment supports the NASA Mars Exploration Rover 1 and 2 (MER-1 and MER-2) Satellite Communications System.

**S825**--This assignment supports the FCC authorized Mabuhay (AGUILA 2) satellite located at 146.0 EL.

**S826**--This assignment supports the FCC authorized GE-3 satellite located at 87.0 WL.

**S828**--This assignment supports the FCC authorized ECHOSTAR 1 satellite located at 148 WL.

**S829**--This assignment supports the FCC authorized ECHOSTAR 2 satellite located at 148 WL.

**S830**--This assignment supports the FCC authorized ECHOSTAR 4 satellite located at 119 WL.

**S831**--This assignment supports the FCC authorized ECHOSTAR 6 satellite located at 119 WL.

**S832**--This assignment supports the FCC authorized GALAXY III-C, GALAXY VIII(I)-R, and GALAXY VIII- I satellites located at 95.0 WL.

**S833**--This assignment supports the FCC authorized EUTELSAT Atlantic Bird-3 satellite located at 5.0 WL.

**S836**--This assignment supports the NASA New Horizons Satellite Communications Systems.

**S837**--This assignment supports the NASA Mars Reconnaissance Orbiter Satellite Communications Systems.

**S839**--This assignment supports the NASA Solar Terrestrial Relations Observatory (STEREO) Satellite Communications System.

**S840**--This assignment supports the FCC authorized Marisat-F2 satellite located at 33.9 W.L.

**S841**--This assignment supports the FCC authorized AMOS satellite located at 4.0 W.L.

**S842**--This assignment supports the NASA DAWN Satellite Communications System.

**S843**--This assignment supports the FCC authorized ESTRELA DO SUL 2 satellite located at 63.0 W.L.

**S844**--This assignment supports the FCC authorized experimental non-voice non-geostationary Aprize satellite.

**S845**--This assignment supports the NASA Aeronomy of Ice in the Mesosphere (AIM) Satellite Communications Systems.

**S848**--This assignment supports the FCC authorized non-geostationary IRS-P6 satellite.

**S849**--This assignment supports the FCC authorized non-geostationary QUICKBIRD-1 satellite.

**S850**--This assignment supports the NASA Time History of Events and Macroscale Interactions during Substorms (THEMIS) Satellite Communications Systems.

**S853**--This assignment supports the FCC authorized Lockheed Martin-133W-RNSS satellite.

**S859**--This assignment supports the FCC authorized Lockheed Martin-107.3W-RNSS satellite.

**S860**--This assignment supports the FCC authorized AMC-9 satellite located at 0830000 RLG.

S861--This assignment supports the FCC authorized non-geostationary ORBVUE-5 satellites.

S865--This assignment supports the geostationary satellite Apstar V at 1380000E.

S867--This assignment supports the non-geostationary satellite IKONOS-2.

S868--This assignment supports the non-geostationary satellite IRS-1C.

S869--This assignment supports the non-geostationary satellite IRS-ID.

S870--This assignment supports the non-geostationary satellite IRS-P6.

S871--This assignment supports the non-geostationary CubeSat Test Bed (CSTB) satellite.

S874--This assignment supports the DOE Cobra Flight Experiment (CFE) Satellite System.

S875--This assignment supports the NASA Gamma Ray Large Area Telescope (GLAST).

S876--This assignment supports the DOC/NASA Joint Polar Satellite System (JPSS).

S877--This assignment supports the FCC authorized Orbit Orbcomm J1 satellite.

S879--This assignment supports the NASA Interstellar Boundary Explorer (IBEX) spacecraft.

S881--This assignment supports the NASA Kepler Satellite Mission System.

S883--This assignment supports the NASA Lunar Reconnaissance Orbiter System.

S885--This assignment supports the NASA Widefield Infrared Survey Explorer System.

S887--This assignment supports the NASA Fast Satellite (FASTSAT) System.

S889--This assignment supports the NASA Orbiting Carbon Observatory (OCO).

S890--This assignment supports the NASA Mars Science Laboratory (MSL).

S891--This assignment supports the FCC authorized INTELSAT 805 satellite located at 55.500 WL.

S892--This assignment supports the FCC authorized HISPASAT 1C satellite located at 30.000 WL.

S893--This assignment supports the FCC authorized ANIK F1 satellite located at 107.300 WL.

S894--This assignment supports the FCC authorized ANIK E2 satellite located at 111.100 WL.

S895--This assignment supports the FCC authorized ANIK E1 satellite located at 118.700 WL.

S896--This assignment supports the FCC authorized AMC-9 satellite located at 83.000 WL.

S897--This assignment supports the FCC authorized AMC-5 (Formerly GE-5) satellite located at 79.000 WL.

S898--This assignment supports the FCC authorized AMC 6 satellite located at 72.000 WL.

S899--This assignment supports the FCC authorized TerreStar 1 satellite located at 111.100 WL.

S900--This assignment supports the NASA Global Precipitation Measurement (GPM) System.

S902--This assignment supports the FCC authorized Horizons-1 at 127 WL.

S904--This assignment supports the Wideband Global SATCOM System (WGS).

S906--This assignment supports the FCC authorized non-geostationary Worldview 60 (WV-1) satellite.

S907--This assignment supports the FCC authorized non-geostationary Worldview 110 (WV-2) satellite.

S908--This assignment supports the DOC Ocean Surface Topography Mission (OSTM).

S910--This assignment supports the FCC authorized AMC satellite constellation.

S911--This assignment supports the FCC authorized fixed-satellite system, NEW DAWN.

S912--This assignment supports the NASA Space Program Radiation Belt Storm Probes (RBSP).

S913--This assignment supports the NASA Space Program Solar Dynamics Observatory (SDO).

S915--This assignment supports the NASA Landsat Data Continuity Mission (LDCM).

S917--This assignment supports the FCC authorized Telstar satellite constellation.

S918--This assignment supports the DOC COSMIC Satellite System.

S919--This assignment supports the FCC authorized New Skies satellite.

S920--This assignment supports the NASA Aquarius mission.

S923--This assignment supports the FCC authorized geostationary satellite system for DIRECTV.

S924--This assignment supports the Air Force Academy Falcon Satellite Program.

S925--This assignment supports the FCC authorized Hughes Network Satellite Systems.

S926--This assignment supports the FCC authorized Newcom International Satellite System.

S927--This assignment supports the FCC authorized ViaSat satellites.

S928--This assignment supports the FCC authorized AMAZONAS satellites.

S930--This assignment supports the FCC authorized APSTAR satellites.

S932--This assignment supports the FCC Authorization of an earth station to communicate with a non-U.S. licensed satellite.

S933--This assignment supports the NASA Juno spacecraft operations.

S934--This assignment supports the NASA Gravity Recovery and Interior Laboratory (GRAIL) spacecraft operations.

**S935**--This assignment supports the NASA Nuclear Spectroscopic Telescope Array (NuSTAR) spacecraft operations.

**S936**--This assignment supports the NASA Soil Moisture Active Passive (SMAP) spacecraft operations.

**S937**--This assignment shall expire upon completion of Mobile User Objective System (MUOS) space program.

**S938**--This assignment supports the NASA Firefly spacecraft operations.

**S939**--This assignment supports the DOD Advance Extremely High Frequency Satellite System (AEHF).

**S940**--This assignment supports the NASA Ice, Cloud, and land Elevation Satellite-2 (ICESat-2).

**S941**--This assignment supports the NASA Mars Atmosphere and Volatile Evolution (MAVEN) mission.

**S942**--This assignment supports the NASA Magnetospheric Multiscale (MMS) mission.

**S943**--This assignment supports the NASA Interface Region Imaging Spectrograph (IRIS) spacecraft operations.

**S945**--This assignment supports a Cubesat or smaller satellite whose name is recorded in circuit remarks field.

**S946**--This assignment supports the NASA Space Launch System (SLS) Program.

**S950**--This assignment supports the NASA Multipurpose Crew Vehicle (MPCV) spacecraft operations.

**S951**--This assignment supports the NASA Cyclone Global Navigation Satellite System (CYGNSS) spacecraft operations.

**S952**--This assignment supports the FCC authorized Morelos 3 satellite at 113.1 degrees west longitude.

**S953**--This assignment supports the NASA Commercial Crew Visiting Vehicle (C2V2) communications subsystem operations on the International Space Station (ISS).

**S954**--This assignment supports the NASA Interior Exploration Using Seismic Investigations, Geodesy, and Heat Transport (InSIGHT) spacecraft operations.

**S955**--This assignment supports the NASA Ionospheric Connection (ICON) Explorer spacecraft operations.

**S956**--This assignment supports the NASA Gravity Recovery and Climate Experiment-Follow-On (GRACE-FO) spacecraft operations.

**S957**--This assignment supports the NASA Transiting Exoplanet Survey Satellite (TESS) operations.

**S958**--This assignment supports the NASA Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer (OSIRIS-REx) spacecraft operations.

**S959**--This assignment supports the NASA Solar Probe Plus (SPP) spacecraft operations.

**S960** – This assignment supports the NASA LandSat-9 mission.

**S961** – This assignment supports the NASA Lucy mission.

**S962** – This assignment supports the NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission.

**S963** – This assignment supports the NASA Restore-L mission.

**S964** – This assignment supports the NASA Wide Field InfraRed Survey Telescope (WFIRST) mission.

**S965**--This assignment supports the NASA Mars 2020 Rover mission.

**S966**– This assignment supports the NASA Polarimeter to Unify the Corona and Heliosphere (PUNCH) spacecraft operations.

**S967** – This assignment supports the Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites (TRACERS) spacecraft operations.

**S968** – This assignment supports the NASA Total and Spectral Solar Irradiance Sensor-2 (TSIS-2) operations.

**S969** – This assignment supports the NASA Interstellar Mapping and Acceleration Probe (IMAP) spacecraft operations.

**S970** – This assignment supports the NASA Global Lyman-alpha Imagers of the Dynamic Exosphere (GLIDE) spacecraft operations.

**S971** – This assignment supports the NASA Surface Water and Ocean Topography (SWOT) spacecraft operations.

**S972** – This assignment supports the NASA OceanSat-3 operations.

**S973** – This assignment supports the DOC Argos Data Collection System (DCS) operations

**S974** – This assignment supports the DOC Psyche spacecraft operations.

**S975** – This assignment supports the DOC Deep Space Climate Observatory (DSCOVR) operations.

**S976** – This assignment supports the NASA-Indian Space Research Organization Synthetic Aperture Radar (NISAR) mission.

**(Last Page in Annex A)**



## Annex B

### Data and Procedures for Assessing Interactions Among Stations in the Space and Terrestrial Services

#### B.1 GENERAL

Chapter 8 of this Manual contains criteria and procedures applicable to spectrum sharing among stations in the space radiocommunication services and between stations in the space and terrestrial radiocommunication services. This Annex supplements Chapter 8 with supporting data and verification procedures appropriately cross-referenced to the various sections of Chapter 8.

##### B.1.1 Limitations on Power and Direction of Maximum Radiation of Stations in the Fixed Service in the Band 8025-8400 MHz

1. Power and antenna pointing limitations are specified in Section 8.2.34. A description is also provided therein of two computerized procedures for checking proposed new stations or systems for compliance with the specified limits during the FAS and SPS review processes.

2. The following table will assist in ensuring that the main antenna beam of a fixed or mobile station does not point at the geostationary orbit. This table is appropriate for use by federal agencies in the earlier planning stages of systems in the fixed and mobile services, within the limitations imposed by the following basic assumptions:

- An e.i.r.p. of +55 dBW, and therefore, a required separation angle of  $1.5^\circ$  from the geostationary orbit;
- An angle of elevation of the antenna main beam between  $-1^\circ$  and  $+4^\circ$ ; and,
- Atmospheric refraction in the range of  $-2^\circ$  to  $0^\circ$ .

3. For an assignment to a station with an antenna elevation angle between  $-1^\circ$  and  $+4^\circ$  with an e.i.r.p. of less than +55 dBW, the azimuthal sectors to be avoided will be smaller, but are contained within the sectors indicated in the table. This table cannot be used where the elevation angle is not between  $-1^\circ$  and  $+4^\circ$ . Calculation of the azimuthal sectors to be avoided for elevation angles not between  $-1^\circ$  and  $+4^\circ$  should be accomplished using ITU-R Report 393 (1990).

##### Ranges of Azimuths to be Avoided (Northern Hemisphere)

Latitude of Terrestrial Station (N)	From	To	From	To
0	88.50	91.50	268.50	271.50
1	88.60	91.73	268.27	271.40
2	88.70	91.95	268.05	271.30
3	88.80	92.18	267.82	271.20
4	88.90	92.41	267.59	271.10
5	88.99	92.63	267.37	271.01
6	89.09	92.86	267.14	270.91
7	89.19	93.09	266.91	270.81
8	89.29	93.33	266.67	270.71
9	89.38	93.56	266.44	270.62
10	89.48	93.80	266.20	270.52
11	89.58	94.04	265.96	270.42
12	89.68	94.28	265.72	270.32
13	89.78	94.52	265.48	270.22
14	89.88	94.76	265.24	270.12
15	89.97	95.01	264.99	270.03
16	90.07	95.26	264.74	269.93
17	90.17	95.52	264.48	269.83
18	90.27	95.77	264.23	269.73
19	90.38	96.03	263.97	269.62
20	90.48	96.30	263.70	269.52
21	90.58	96.57	263.43	269.42
22	90.68	96.84	263.16	269.32

<b>Latitude of Terrestrial Station (N)</b>	<b>From</b>	<b>To</b>	<b>From</b>	<b>To</b>
23	90.79	97.12	262.88	269.21
24	90.89	97.40	262.60	269.11
25	91.00	97.69	262.31	269.00
26	91.11	97.98	262.02	268.89
27	91.22	98.28	261.72	268.78
28	91.33	98.58	261.42	268.67
29	91.44	98.89	261.11	268.56
30	91.56	99.21	260.79	268.44
31	91.67	99.54	260.46	268.33
32	91.79	99.87	260.13	268.21
33	91.91	100.21	269.79	268.09
34	92.03	100.56	259.44	267.97
35	92.16	100.92	259.08	267.84
36	92.28	101.29	258.71	267.72
37	92.41	101.67	258.33	267.59
38	92.54	102.06	257.94	267.46
39	92.68	102.46	257.54	267.32
40	92.82	102.88	257.12	267.18
41	92.96	103.31	256.69	267.04
42	93.11	103.75	256.25	266.89
43	93.26	104.21	255.79	266.74
44	93.41	104.69	255.31	266.59
45	93.57	105.19	254.81	266.43
46	93.74	105.70	254.30	266.26
47	93.91	106.24	253.76	266.09
48	94.08	106.80	253.20	265.92
49	94.26	107.38	252.62	265.74
50	94.45	107.99	252.01	265.55
51	94.65	108.63	251.37	265.35
52	94.85	109.30	250.70	265.15
53	95.06	110.00	250.00	264.94
54	95.29	110.74	249.26	264.71
55	95.52	111.53	248.47	264.48
56	95.76	112.35	247.65	264.24
57	96.02	113.23	246.77	263.98
58	96.29	114.17	245.83	263.71
59	96.57	115.17	244.83	263.43
60	96.87	116.23	243.77	263.13
61	97.19	117.38	242.62	262.81
62	97.52	118.61	214.39	262.48
63	97.88	119.95	240.05	262.12
64	98.27	121.40	238.60	261.73
65	98.68	122.99	237.01	261.32
66	99.13	124.73	235.27	260.87
67	99.60	126.66	233.34	260.40
68	100.13	128.82	231.18	259.87
69	100.69	131.25	228.75	259.31
70	101.31	134.02	225.98	258.69
71	102.00	137.23	222.77	258.00
72	102.75	141.03	218.97	257.25
73	103.60	145.68	214.32	256.40
74	104.55	151.67	208.33	255.45
75	105.62	160.34	199.66	254.38

### Ranges of Azimuths to be Avoided (Southern Hemisphere)

Latitude of Terrestrial Station (S)	From	To	From	To
0	88.50	91.50	268.50	271.50
1	88.27	91.40	268.70	271.73
2	88.05	91.30	268.70	271.95
3	87.82	91.20	268.80	272.18
4	87.59	91.10	268.90	272.41
5	87.37	91.01	268.99	272.63
6	87.14	90.91	269.09	272.86
7	86.91	90.81	269.19	273.09
8	86.67	90.71	269.29	273.33
9	86.44	90.62	269.38	273.56
10	86.20	90.52	269.48	273.80
11	85.96	90.42	269.58	274.04
12	85.72	90.32	269.68	274.28
13	85.48	90.22	269.78	274.52
14	85.24	90.12	269.88	274.76
15	84.99	90.03	269.97	275.01
16	84.74	89.93	270.07	275.26
17	84.48	89.83	270.17	275.52
18	84.23	89.73	270.27	275.77
19	83.97	89.62	270.38	276.03
20	83.70	89.52	270.48	276.30
21	83.43	89.42	270.58	276.57
22	83.16	89.32	270.68	276.84
23	82.88	89.21	270.79	277.12
24	82.60	89.11	270.89	277.40
25	82.31	89.00	271.00	277.69
26	82.02	88.89	271.11	277.98
27	81.72	88.78	271.22	278.28
28	81.42	88.67	271.33	278.58
29	81.11	88.56	271.44	278.89
30	80.79	88.44	271.56	279.21
31	80.46	88.33	271.67	279.54
32	80.13	88.21	271.79	279.87
33	79.79	88.09	271.91	280.21
34	79.44	87.97	272.03	280.56
35	79.08	87.84	272.16	280.92
36	78.71	87.72	272.28	281.29
37	78.33	87.59	272.41	281.67
38	77.94	87.46	272.54	282.06
39	77.54	87.32	272.68	282.46
40	77.12	87.18	272.82	282.88
41	76.69	87.04	272.96	283.31
42	76.25	86.89	273.11	283.75
43	75.79	86.74	273.26	284.21
44	75.31	86.59	273.41	284.69
45	74.81	86.43	273.57	285.19
46	74.30	86.26	273.74	285.70
47	73.76	86.09	273.91	286.24
48	73.20	85.92	274.08	286.80
49	72.62	85.74	274.26	287.38
50	72.01	85.55	274.45	287.99
51	71.37	85.35	274.65	288.63
52	70.70	85.15	274.85	289.30
53	70.00	84.94	275.06	290.00
54	69.26	84.71	275.29	290.74
55	68.47	84.48	275.52	291.53

Latitude of Terrestrial Station (S)	From	To	From	To
56	67.65	84.24	275.76	292.35
57	66.77	83.98	276.02	293.23
58	65.83	83.71	276.29	294.17
59	64.83	83.43	276.57	295.17
60	63.77	83.13	276.87	296.23
61	62.62	82.81	277.19	297.38
62	61.39	82.48	277.52	298.61
63	60.05	82.12	277.88	299.95
64	58.60	81.73	278.27	301.40
65	57.01	81.32	278.68	302.99
66	55.27	80.87	279.13	304.73
67	53.34	80.40	279.60	306.66
68	51.18	79.87	280.13	308.82
69	48.75	79.31	280.69	311.25
70	45.98	78.69	281.31	314.02
71	42.77	78.00	282.00	317.23
72	38.97	77.25	282.75	321.03
73	34.32	76.40	283.60	325.68
74	28.33	75.45	284.55	331.67
75	19.66	74.38	285.62	340.34

### B.1.2 Earth Station Antenna Elevation Angle and EIRP Toward the Horizon

1. For transmitting earth stations in the bands 7900-7975 and 8025-8400 MHz, Section 8.2.35 places an upper limit on the equivalent isotropically radiated power (EIRP) toward the horizon and a minimum antenna elevation angle above the horizontal plane.

2. Earth stations should be evaluated for compliance with those provisions before or at the time of the systems review under Chapter 10. An algorithm to perform this evaluation is presented below together with an illustrative example.

#### Algorithm

3. Frequency Check: Determine whether the system under consideration includes a transmitting earth station operating in either the 7900-7975 or 8025-8400 MHz band. If it does not, terminate the check. Does the transmitting earth station operate in either of the above bands?

YES \_ NO \_

4. Antenna Elevation Angle: Check for compliance with minimum antenna elevation angle requirements. Use the planned minimum operating elevation angle of the antenna as provided in the systems review data. The requirements for the various services are as follows:

- a. Space Research (Deep Space)  $\leq 10^\circ$
- b. Space Research (Near Earth)  $\leq 5^\circ$
- c. Other Earth Stations  $\leq 3^\circ$

If the appropriate limitation is not met, the constraints of Section 8.2.35 are violated. Does the station meet the criteria for the applicable service?

YES \_ NO \_

5. EIRP Limitations: These limitations are a function of the horizon elevation angle. As an upper bound on the EIRP limitation, determine the maximum EIRP in a 409 kHz band (antenna mainbeam gain in dB above isotropic + maximum power density in dBW/Hz + 36 dB [conversion from 1 Hz to 4 kHz]). If this value is below 40 dBW/4 kHz, then the system meets the EIRP criteria, if not, perform the more detailed examination explained below.

6. Compute the EIRP/4 kHz ( $P_h$ ) radiated toward the horizon for each intended operating azimuth using the following data<sup>1</sup>:

- $\Phi$  Planned operating azimuth angles;
- $\theta_2$  Elevation angle of the horizon measured from the horizontal plane for the  $\Phi$  azimuth;
- $\theta_1$  Operating elevation angle of the antenna above the horizontal plane for the  $\Phi$  azimuth;
- $G$  Antenna pattern information; and
- $P$  Maximum power density in dBW/Hz averaged over the worst 409 kHz band.

**Computation:**

$$P_h = P + 36 + G^\Phi (\theta_1 - \theta_2) \text{ dBW/4 kHz}$$

Where  $G^\Phi (\theta_1 - \theta_2)$  is the gain of the antenna

$\theta_1 - \theta_2$  degrees off axis, determined for each azimuth  $\Phi$ .

Check  $P_h$  (EIRP/4 kHz) for compliance with the following limits:

Horizon	$P_h$ limits
$\theta_2 > 5^\circ$	No restriction
$0^\circ < \theta_2 \leq 5^\circ$	$< 40 + 3\theta_2$ dBW/4 kHz
$\theta_2 \leq 0^\circ$	$< 40$ dBW/4 kHz

If  $P_h$  exceeds these limits, the constraints of Section 8.2.35 are violated. Does the station meet the above EIRP limits?

**YES \_ NO \_**

A station to be in compliance with Section 8.2.35 must conform to the criteria under the three headings above for all azimuths.

**Illustrative Example**

Data Submitted:

**Station:** Earth Station in the Fixed-Satellite Service

Frequency: 8.23 GHz.

**Power Density:**  $P = -6$  dBW/Hz.

Mainbeam Azimuth:  $\Phi = 103^\circ$

Mainbeam Elevation Angle:  $\theta_1 = 8^\circ$  for  $\Phi = 103^\circ$

**Horizon Elevation Angle:**  $\theta_2 = 3^\circ$  for  $\Phi = 103^\circ$  (extracted from geographical data provided for horizon around earth station)

**Mainbeam Antenna Gain:** 51 dB

**Antenna Gain:**  $G^\Phi (\theta_1 - \theta_2) = 14.5$  dB

This gain is at the natural horizon at an azimuth of  $103^\circ$  and is taken from a point on the graphical antenna pattern  $5^\circ$  from the center of the mainbeam ( $\theta_1 - \theta_2 = 5^\circ$ ).

**Frequency Check:** The submitted transmitting frequency is in one of the specified bands.

**Operating Elevation Angle:** The minimum operating elevation angle of  $8^\circ$  does meet the criteria for the fixed-satellite service.

**EIRP Limitations:** The maximum EIRP is 81 dBW/4 kHz ( $51 + 36 - 6$  dBW/4 kHz). As this exceeds the value of 40 dBW/4 kHz, a detailed examination must be made.

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<sup>1</sup> All data elements are required under Chapter 10 by reference to Appendixes 3 and 4 to the ITU Radio Regulations.

### Computation of EIRP toward the horizon:

$$\begin{aligned} Ph &= -6 + 36 + 14.5 \text{ dBW/4 kHz} \\ &= 44.5 \text{ dBW/4 kHz} \end{aligned}$$

The criterion for a horizon elevation of  $3^\circ$  is 49 dBW/4 kHz ( $40 + 3.3^\circ$ ). The computed EIRP toward the horizon is less than the criterion and therefore complies with the constraint.

As the data in this example meet the criteria in each of the headings, the station complies with Section 8.2.35.

## B.1.3 POWER FLUX DENSITY LIMITS

1. Section 8.2.36 specifies constraints on the power flux density (PFD) from space stations in certain bands. The constraints are of three forms: a) PFD limits at the Earth's surface in dBW/m<sup>2</sup>/4 kHz (or in some bands /1 MHz or /1.5 MHz); b) power spectral density at the receiver input of a troposcatter system in dBW/4 kHz; and c) PFD limits in dBW/m<sup>2</sup>/4 kHz at the geostationary orbit from space stations using non-geostationary orbits.

2. The latter constraint is applicable only to the space-to-Earth operations in the earth exploration-satellite service in the band 8025-8400 MHz. Compliance with this provision of Section 8.2.36 will be examined on a case-by-case basis and will not be further considered in the Annex.

3. The constraint on the power spectral density from a space station at the receiver input of a troposcatter system applies in the bands 1670-1700, 1700-1710, and 2200-2300 MHz. In view of the very small number of troposcatter systems within the US&P in these bands, examination of proposed systems for compliance with this provision will be considered on a case-by-case basis.

4. Limitations on the PFD at the Earth's surface from a space station are imposed in most of the downlink bands between 1670 MHz and 22 GHz which are shared with the terrestrial services. Evaluation of space stations for compliance with this provision should be accomplished before or at the time of the systems review under Chapter 10. An algorithm to perform this evaluation is presented below together with an illustrative example.

### Algorithm

5. This algorithm checks compliance with the PFD limits at the Earth's surface from a space station in the geostationary orbit.

6. Frequency Band/Service Check: Determine whether the proposed system is for one of the combinations of frequency band and radio service given in Table 1. If it is not, terminate the check. Determine whether the satellite is in the geostationary orbit. If it is not, a case-by-case review is necessary. Is the space station in a geostationary orbit and in a frequency band and service combination given in Table 1?

YES \_ NO \_

7. Power Flux Density Limits: The PFD of the station at the Earth's surface must be computed and compared with established criteria. When earth coverage antennas are used in the satellite, the antenna gain across the visible portion of the Earth's surface is assumed to be constant. When spot beam antennas are used, a worst case is assumed (full gain) unless a complete description of the pattern, side lobes, and exact pointing direction is provided. In that case a detailed examination is necessary.

8. The most stringent PFD limitation on satellites with Earth coverage antennas is imposed for low angles of arrival at the Earth's surface. Thus the computed PFD is compared with the limits imposed at low angles of arrival (see Table 1).

9. It is recognized that the limitations are referenced to different bandwidths (i.e., 4 kHz, 1 MHz, and 1.5 MHz). Thus it is necessary to select the appropriate bandwidth from Table 1 for the particular band and service under consideration.

10. In computing the PFD, it is assumed that:

- Atmospheric losses are negligible;
- The geostationary orbit is 35,700 km; and,
- The Earth's radius is constant, i.e., the Earth is smooth.

To compute the power flux density PE at the Earth's surface, the following data are used:

$P_D$  Maximum power spectral density in dBW/Hz averaged over the reference bandwidth (4 kHz, 1 MHz, or 1.5 MHz).

$B_R$  Reference bandwidth in Hz.

$G$  Mainbeam antenna gain in dB.

The computation to determine the power flux density is:

$$P_E = P_D + 10 \log B_R + G - 163 \text{ dBW/m}^2 / B_R$$

Once this value is determined, it is checked against the appropriate criteria given in Table 1.

Is the computed PFD less than (more negative) than the applicable value given in Table 1?

YES \_ NO \_

A station to be in compliance with Section 8.2.36 must conform to the criteria specified in Table 1.

### Illustrative Example

#### Data Submitted:

**Frequency Band:** 7300-7750 MHz

**Service:** Fixed-Satellite

**Orbit:** Geostationary

**Power Density:** -46 dBW/Hz

**Antenna Gain:** 17 dB

**Table: Power Flux Density Limits at the Earth's Surface from Space Stations in Bands Shared with the Fixed and Mobile Services**

Frequency Band (MHz)	Space Radiocommunication Service	Limit
1670-1690	Meteorological-Satellite	-154 dBW/m <sup>2</sup> /4 kHz
1690-1700	Meteorological & Earth Exploration-Satellite (for countries mentioned in ITU RR 5.382)	
1700-1710	Space Research	
2200-2300	Space Research	
7300-7750	Fixed-Satellite	
7450-7550	Meteorological-Satellite	-152 dBW/m <sup>2</sup> /4 kHz
8025-8400	Fixed-Satellite	
8025-8400	Earth Exploration-Satellite	-150 dBW/m <sup>2</sup> /4 kHz
8400-8500	Space Research	
21200-22000	Earth Exploration-Satellite	
1690-1700	Meteorological & Earth Exploration-Satellite	-133 dBW/m <sup>2</sup> /4 kHz

11. Frequency Band/Service Check: The space station described above is in the geostationary orbit and operates in a frequency band and radiocommunication service given in Table 1.

12. Power Flux Density Limits: The reference bandwidth for the band under consideration is 4 kHz. Using this value and the above data, the computed power flux-density is -156 dBW/m<sup>2</sup>/4 kHz (-46 + 36 + 17 -163 dBW/m<sup>2</sup>/4 kHz). This value is less than (more negative) the limit of -152 dBW/m<sup>2</sup>/4 kHz specified in Table 1, and, therefore, the station complies with the provisions in Section 8.2.36.

**(Last Page in Annex B)**



## Annex C

### Authorized Sites for Certain Federal Experimental Stations Under Section 7.11

#### C.1 Authorized Sites for Experimental Operations Under Subsection 7.11.3

##### C.1.1 United States Air Force

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Arnold Engineering Development Complex AEDC/TSDIA, Arnold AFB	35-21-52 N 086-11-17 W, 35-18-50 N 086-06-27 W, 35-24-01 N 086-00-17 W, 35-27-10 N 086-04-14 W, 35-22-57 N 086-05-50 W	AEDC/TSDIA 100 Kindel Dr. Suite B212 Arnold AFB, TN 37389-2212 Telephone: 931-454-6996 DSN: 340-6996 Stop Buzzer: 931-454-6996 DSN: 340-6996
Air Force Life Cycle Management Center (AFLCMC- WP) Wright Patterson AFB Area A and B	39-49-59 N 084-01-20 W, 39-50-31 N 084-02-38 W, 39-48-43 N 084-04-41 W, 39-48-04 N 084-03-40 W, 39-47-35 N 084-04-46 W, 39-47-31 N 084-05-56 W, 39-46-28 N 084-07-16 W, 39-46-31 N 084-04-51 W	AFLCMC- WPAFB OH RF Spectrum Management Branch, 88th Communications Squadron/SCXF 3810 Communications Blvd, Area A, Bldg. 1455, Room 201 Wright-Patterson AFB, OH 45433-7661 Telephone: 937-255- 2181, DSN: 785-2181 Stop Buzzer: During Duty Hours: 937-255-2181, DSN: 785-2181 After Duty Hours: 88ABW Command Post (937) 257-6314, DSN: 787- 6314
AFLCMC-WP, FAA/Wright Patterson AFB Certificate to Operate Small Unmanned Aerial System below 400 feet	39-46-33 N 084-05-57 W, 39-46-35 N 084-06-45 W, 39-46-24 N 084-06-54 W, 39-46-20 N 084-05-44 W	AFLCMC- WPAFB OH RF Spectrum Management Branch 88th Communications Squadron/SCXF 3810 Communications Blvd, Area A, Bldg. 1455, Room 201 Wright-Patterson AFB, OH 45433-7661 Telephone: 937-255-2181, DSN: 785-2181 Stop Buzzer: During Duty Hours: Telephone: 937-255-2181, DSN: 785-2181 After Duty Hours: 88ABW Command Post Telephone: 937-257-6314, DSN 787- 6314
Edwards Main Ramp	345521N1175256W 1 km radius	Air Force Test Center (AFTC-Edwards) 412CS/SCOTS Building 300, Room 119 Edwards AFB, CA 93524-1110 Telephone: 661-277-4756, DSN: 527-4756 Fax: 661-277-4756, DSN: 527-4756 Secure Voice/Fax: 661-277-4765 DSN: 527-4765 Stop Buzzer: 661-277-4763, 661-810-8694, 661- 810-4858, DSN: 527-4763
Edwards South Base Ramp	345477N1175232W 1 km radius	Air Force Test Center (AFTC-Edwards) 412CS/SCOTS Building 300, Room 119 Edwards AFB, CA 93524-1110 Telephone: 661-277-4756, DSN: 527-4756 Fax: 661-277-4756, DSN: 527-4756 Secure Voice/Fax: 661-277-4765 DSN: 527-4765 Stop Buzzer: 661-277-4763, 661-810-8694, 661- 810-4858, DSN: 527-4763
Edwards North Base Ramp	34-59-26 N 117-51-47 W 1 km radius	

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Air Force Flight Test Center, Edwards	37-10-00 N 119-20-00 W, 37-10-00 N 117-20-00 W, 35-40-00 N 115-30-00 W, 34-30-00 N 116-50-00 W, 34-30-00 N 118-20-00 W	
Air Force Civil Engineering Center (AFCEC), Tyndall AFB , FL	30-01-47 N 085-32-30 W, 30-01-15 N 085-30-00 W, 30-01-00 N 085-27-00 W, 29-59-00 N 085-36-30 W, 29-56-00 N 085-33-00 W, 29-54-00 N 085-27-00 W, 29-55-45 N 085-41-30 W, 29-44-50 N 085-31-00 W	Air Force Civil Engineering Center (AFCEC) Tyndall AFB, FL 32401-6001 Tyndall ISM Telephone: 850-283-4764, DSN: 523-4764
Eglin Range Site D-3 Cape San Blas	29-39-44 N 085-20-48 W, 29-40-32 N 085-20-01 W, 29-41-50 N 085-20-10 W, 29-41-08 N 085-20-23 W, 29-41-59 N 085-21-13 W, 29-40-41 N 085-21-58 W, 29-40-12 N 085-21-26 W	DOD Gulf Area Frequency Coordinator (GAFC) 95 CS/SCXF 201 W. Eglin Blvd, Ste. 207 Eglin AFB, FL 32542-6829 Normal Duty hours: 850-883-7535, DSN: 875-7535, After Hours: 850-496-1867 Stop Buzzer: 850-883 7535
Eglin Land Ranges		
Field 10	30-30-34 N 086-57-25 W 2.15 km radius	
Field 16	30-37-31 N 086-44-37 W 2.75 km radius	
B-70 Complex	30-37-26 N 086-37-25 W 30-30-23 N 086-34-11 W 30-26-30 N 086-50-05 W 30-33-58 N 086-52-55 W	
Duke Field	30-38-57 N 086-31-22 W 2.25 km radius	
Field 1 Complex	30-41-32 N 086-28-00 W 30-40-18 N 086-23-48 W 30-33-50 N 086-26-54 W 30-33-49 N 086-29-31 W	
C” Range Complex	30-42-12 N 086-23-02 W 30-42-30 N 086-15-20 W 30-39-34 N 086-12-44 W 30-34-12 N 086-09-53 W 30-30-35 N 086-17-25 W 30-33-51 N 086-23-36 W	
Eglin Main Base	30-29004 N 086-30-38 W 1.5 km radius	
Hurlburt Field	30-25-28 N 086-40-30 W 0.4 km radius	

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Eglin Land Range	30-28-14 N 086-34-41 W, 30-26-56 N 086-34-38 W, 30-26-57 N 086-32-10 W, 30-27-48 N 086-29-19 W, 30-28-58 N 086-28-39 W, 30-30-20 N 086-30-45 W, 30-32-37 N 086-30-48 W, 30-32-32 N 086-25-05 W, 30-27-56 N 086-23-40 W, 30-30-56 N 086-14-54 W, 30-32-22 N 086-07-30 W, 30-33-41 N 086-06-33 W, 30-37-22 N 086-07-11 W, 30-37-45 N 086-11-29 W, 30-44-34 N 086-15-35 W, 30-42-17 N 086-23-31 W, 30-40-51 N 086-36-00 W, 30-39-36 N 086-44-47 W, 30-31-24 N 086-58-25 W, 30-28-29 N 086-56-08 W, 30-28-13 N 086-53-59 W, 30-25-47 N 086-48-20 W, 30-25-02 N 086-48-20 W, 30-24-55 N 086-42-51 W, 30-24-06 N 086-42-52 W, 30-24-10 N 086-44-03 W, 30-24-03 N 086-45-26 W, 30-23-19 N 086-51-07 W, 30-22-49 N 086-51-07 W, 30-24-05 N 086-38-00 W, 30-24-37 N 086-41-03 W, 30-26-29 N 086-40-01 W, 30-26-44 N 086-39-35 W, 30-28-21 N 086-39-41 W, 30-23-33 N 086-34-43 W, 30-23-03 N 086-30-50 W, 30-23-27 N 086-30-57 W, 30-23-45 N 086-32-02 W, 30-23-48 N 086-34-40 W	DOD Gulf Area Frequency Coordinator (GAFC) 5 CS/SCXF 201 W. Eglin Blvd, Ste. 207 Eglin AFB, FL 32542-6829 Normal Duty hours: Telephone: 850-883-7535, DSN: 875-7535, After Hours: Telephone: 850-496-1867, DSN: 872-3523 Stop Buzzer: 850-883 7535
AFLCMC-Hanscom	42-27-30 N 071-16-12 W 1 km radius	AFLCMC-Hanscom 66 ABG/SCOI 30 Hamilton Street Hanscom AFB, MA 01731-1621 Telephone: 781-225-2628, DSN: 478-2628 Alternate: 781-225-6020, DSN: 845-6020 Stop Stop Buzzer: 781-225-2628 or 781-225-6020
Space and Missile Systems Center, Huntington Beach CA	33-45-17 N 118-02-30 W, 33-44-13 N 118-01-28 W, 33-45-17 N 118-01-28 W, 33-44-13 N 118-02-30 W	Space and Missile Systems Center (SMC) SMC/ENCS, Los Angeles AFB 483 N. Aviation Blvd. El Segundo, CA 90245-2808 Telephone: 310-653-1428, DSN: 633-1428 Stop Buzzer: 310-653-1428, DSN: 633-1428

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Santa Rosa Island Test Sites		DOD Gulf Area Frequency Coordinator (GAFC) 95 CS/SCXF 201 W. Eglin Blvd, Ste 207 Eglin AFB, FL 32542-6829 Normal Duty hours: 850-883-7535, DSN: 875-7535, After Hours: 850-496-1867 Stop Buzzer: 850-883 7535
Test Site A-17	30-23-05 N 086-50-21 W 0.15 km radius	
Test Site A-15	30-23-17 N 086-48-22 W 0.5 km radius	
Test Site A-13B	30-23-29 N 086-46-03 W 0.3 km radius	
Test Site A-13	30-23-36 N 086-45-31 W 0.3 km radius	
Test Site A-11B	30-23-51 N 086-42-44 W 0.3 km radius	
Test Site A-10	30-23-52 N 086-42-00 W 0.4 km radius	
Test Site A-7	30-23-17 N 086-48-22 W 0.5 km radius	
Eglin Water Test Area W-155	30-05-09 N 088-01-30 W, 28-51-22 N 088-01-30 W, 28-30-22 N 086-40-00 W, 30-20-16 N 086-47-60 W	
Eglin Water Range W-470	29-32-31 N 085-00-00 W, 29-42-35 N 084-40-00 W, 28-56-00 N 083-31-00 W, 28-05-00 N 083-31-00 W, 28-02-23 N 085-00-00 W	
Eglin Water Range W-151	30-20-16 N 086-47-60 W, 30-12-11 N 086-00-00 W, 29-32-31 N 085-00-00 W, 28-02-23 N 085-00-00 W, 28-30-22 N 086-40-00 W	
Space and Missile Systems Center, Los Angeles AFB CA	33-55-51 N 118 23 46 W, 33-53-14 N 118-23-46 W, 33-53-14 N 118-21-40 W, 33-55-55 N 118-21-40 W	Space and Missile Systems Center (SMC) SMC/ENCS, Los Angeles AFB 483 N. Aviation Blvd. El Segundo, CA 90245-2808 Telephone: 310-653-1428, DSN: 633-1428 Stop Buzzer: 310-653-1428, DSN: 633-1428
Air Force Research Laboratory/Phillips Research Site, Kirtland AFB, NM	35-03-26 N 106-36-26 W, 35-03-27 N 106-33-36 W, 35-02-43 N 106-33-35 W, 35-01-43 N 106-27-32 W, 34-56-55 N 106-25-06 W, 34-56-52 N 106-34-07 W	Air Force Research Laboratory/Phillips Research Site 3550 Aberdeen Avenue, S.E. Kirtland AFB, NM 87117-5776 Telephone: 505-853-4313, DSN: 263-4313 After Hours 505-249-8892 Fax: 505-846-7364, DSN: 246-7364 Stop Buzzer: 505-853-4313
Fallon Gabbs South MOA	38-43-00 N 118-11-55 W, 38-40-00 N 118-05-22 W, 38-40-00 N 118-00-05 W, 38-56-00 N 117-23-05 W, 39-10-00 N 117-23-05 W, 38-43-00 N 118-02-05 W	Nevada Area Frequency Coordinator (ACC) 99 CS/NAFC 5870 Devlin Drive Nellis AFB, NV 89191-7075 Telephone: 702-679-0607 DSN: 679-0607 Stop Buzzer: 702-652-3417 DSN: 683-3417
Fallon Carson MOA	40-06-00 N 117-58-35 W, 40-08-00 N 118-15-01 W, 39-57-00 N 118-38-07 W, 39-51-00 N 118-38-07 W, 40-01-00 N 118-15-07 W	

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Fallon Gabbs Central MOA	39-06-09 N 118-34-02 W, 38-58-00 N 118-43-30W, 39-43-00 N 118-11-55 W, 38-43-00 N 118-02-05 W, 39-10-00 N 117-23-05 W	Nevada Area Frequency Coordinator (ACC) 99 CS/NAFC 5870 Devlin Drive Nellis AFB, NV 89191-7075 Telephone: 702-679-0607 DSN: 679-0607 Stop Buzzer: 702-652-3417 DSN: 683-3417
Fallon Gabbs MOA	39-06-08 N 118-33-62 W, 39-10-00 N 117-23-05 W, 39-55-00 N 117-26-05 W, 40-06-00 N 117-48-05 W, 40-06-00 N 117-57-55 W, 40-01-00 N 118-15-07 W, 39-51-00 N 118-38-07 W, 39-45-88 N 118-38-34 W, 39-25-00 N 118-25-57 W, 39-17-00 N 118-21-07 W	
NTTR Operational Areas	37-53-00 N 117-06-00 W, 38-15-00 N 116-18-00 W, 38-14-00 N 115-00-00 W, 37-53-00 N 113-37-00 W, 36-43-00 N 114-34-00 W, 36-24-00 N 115-20-00 W, 36-40-00 N 116-27-00 W, 37-25-00 N 117-07-00 W	
UTTR and Dugway	40-33-45 N 113-54-02 W, 40-36-08 N 113-02-10 W, 39-56-26 N 113-45-28 W, 40-06-38 N 112-50-10 W	NAFC: Nevada Area Frequency Coordinator (ACC) 99 CS/NAFC 5870 Devlin Drive Nellis AFB, NV 89191-7075 Telephone: 702-679-0607 DSN: 679-0607 Stop Buzzer: 702-652-3417 DSN: 683-3417
Patrick AFB	28-14-23 N 080-36-26 W 1 km radius	DoD Eastern Area Frequency Coordinator Office (EAFC) 14820 Samuel C Phillips Pkwy Cape Canaveral AFS, FL Telephone: 321-853-8426 (Duty Hours) DSN (467) Stop Buzzer: 321-853-8426 (24 hours) E-Mail: 45sw.dodeafc@usaf.mil
Cape Canaveral Air Force Station Florida	28-28-05 N 080-34-04 W 7 km radius	DoD Eastern Area Frequency Coordinator Office (EAFC) 14820 Samuel C Phillips Pkwy Cape Canaveral AFS, FL Telephone: 321-853-8426 (Duty hours) DSN (467) Stop Buzzer: 321-853-8426 (24 hours) Email: 45sw.dodeafc@us.af.mil
Air Force Civil Engineering Center  (AFCEC), Tyndall AFB, FL	30-01-47 N 085-32-30 W, 30-01-15 N 085-30-00 W, 30-01-00 N 085-27-00 W, 29-59-00 N 085-36-30 W, 29-56-00 N 085-33-00 W, 29-54-00 N 085-27-00 W, 29-55-45 N 085-41-30 W, 29-44-50 N 085-31-00 W	Air Force Civil Engineering Center (AFCEC) Tyndall AFB, FL 32401-6001  Tyndall ISM Telephone: 850-283-4764 DSN: 523-4764
96th Test Group, High Speed Track	33-01-35 N 106-10-11 W, 33-01-35 N 106-09-01 W, 32-52-50 N 106-08-15 W, 32-52-50 N 106-09-20 W	746th Test Squadron Mr. Eric Hendren 746 TS/TGGN 1644 Vandergrift Road Holloman AFB, NM 88330 Eric.hendren@us.af.mil Telephone: 575-679-1941, DSN: 349-1941

96th Test Group, Small Antenna Test Range	32-53-30 N 106-04-59 W 5 km radius	746th Test Squadron Mr. Eric Hendren 746 TS/TGGTN 1644 Vandergrift Road Holloman AFB, NM 88330 Eric.hendren@us.af.mil Telephone: 575-679-1941; DSN: 349-1941 Stop Buzzer: 575-442-0047, 575-430-6413  Mr. James Manns 746 TS/TGGTN 1644 Vandergrift Road Holloman AFB, NM 88330 James.manns.2@us.af.mil Telephone: 575-679-1707; DSN: 349-1707 Stop Buzzer: 575-442-0047, 575-430-6413
Air Force Research Laboratory, Rome Research Site, NY	43-12-46 N 075-27-22 W 3 km radius	Air Force Research Laboratory (ARFL) 26 Electronic Parkway, Suite W2 Rome, New York 13441-4514 Telephone: 315-330-4586 DSN: 587-4586 Stop Buzzer: 315-330-4586
Air Force Research Laboratory, Stockbridge Test Site, NY Small Unmanned Aerial System Below 400 Feet	42-59-28 N 075-35-58 W 3 km radius	Air Force Research Laboratory (ARFL) 26 Electronic Parkway, Suite W2 Rome, New York 13441-4514 Telephone: 315-330-4586, DSN: 587-4586 Stop Buzzer: 315-330-4586
Air Force Research Laboratory, Newport Site, NY	43-08-49 N 075-02-40 W 3 km radius	Air Force Research Laboratory (ARFL) 26 Electronic Parkway, Suite W2 Rome, New York 13441-4514 Telephone: 315-330-4586, DSN: 587-4586 Stop Buzzer: 315-330-4586
Western Space and Missile Center (WSMS), Vandenberg AFB	34-54-37 N 120-40-01 W, 34-49-40 N 120-32-51 W, 34-27-00 N 120-25-19 W, 34-26-55 N 120-28-17 W, 34-33-51 N 120-37-59 W, 34-42-13 N 120-35-56 W, 34-45-24 N 120-38-02 W, 34-51-21 N 120-36-28 W	Western Space and Missile Center (WSMS) Vandenberg AFB, CA 93437-6021 Telephone: 805-605-3660, DSN: 275-3660 E-mail: 30scs.scorf@us.af.mil Stop Buzzer: 805-606-9247
Joint Pacific Alaska Range Complex (JPARC)	65-00-00 N 146-43-43 W, 65-00-00 N 143-00-00 W, 64-00-00 N 144-00-00 W, 64-00-00 N 143-00-00 W, 63-37-00 N 144-13-00 W, 63-37-00 N 145-33-00 W, 63-30-00 N 145-54-00 W, 63-30-00 N 148-16-46 W, 63-58-00 N 148-00-00 W, 64-22-28 N 147-58-09 W	Combined Headquarters ANR-ALCOM (CHQ ANR-ALCOM) J64 Joint Base Elmendorf-Richardson, AK 99506- 2101 Telephone: 907-552-8223 Fax: 907-552-6965 Stop Buzzer: 907-337-3125 (Primary) 907-377-2322 (Secondary)
Playas Training and Research Center (PTRC)	31-55-01 N 108-32-02 W 5 km radius	HQ Air Combat Command/A6OF 180 Benedict Ave, Bldg. 558 JB Langley-Eustis, VA 23665-1993 Telephone: 757-764-5715 or 757-574-3704 Stop Buzzer: 757-764-5715 (Primary) or 757-574-3704 (Alternate)

## C.1.2 United States Army

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Fort Dix/Lakehurst	40-01-40 N 074-26-29 W 5 km radius (Test Area 1)	CERDEC Ground Activity 385 Hockamick Rd. Cookstown NJ, 08511 Stop Buzzer: 848-667-0913
	39-57-34 N 074-24-19 W 4 km radius (Test Area 2)	
	40-01-34 N 074-25-21 W 4 km radius (Test Area 3)	
Picatinny Arsenal NJ	40-56-51 N 074-32-38 W 3 km radius	Army Frequency Management Office US&P ATTN: AFMO US&P 2350 Stanley Road, Suite 32 JB SA Ft. Sam Houston, TX 78234-2720 Stop Buzzer: 210-221-2050/0454/2820 DSN: 471 2050/0454/2820
Aberdeen Proving Ground	39-27-22 N 076-05-60 W 4 km radius (Test Area 1) 39-27-10 N 076-08-51 W 4 km radius (Test Area 2) 39-25-46 N 076-10-03 W 4 km radius (Test Area 3) 39-21-44 N 076-17-11 W 4 km radius (Test Area 4)	Aberdeen Test Center 400 Collieran Rd. Aberdeen Proving Ground, MD 21005 Stop Buzzer: 410-278-0551, DSN: 298-0551
Army Research Laboratory (ARL) – Adelphi Laboratory Center (ALC)	39-02-10 N 076-57-20 W 1 km radius	Army Research Laboratory (ARL) – Adelphi Laboratory Center (ALC), ARL-ALC, ATTN: Frequency Coordinator, 2800 Powder Mill Road, Adelphi, MD 20783-1138 Stop Buzzer: 301-394-2533, DSN: 290-2533
Army Aviation and Missile Command, Redstone Arsenal	34-37-00 N 086-39-00 W 6 km radius	Army Aviation and Missile Command ATTN: AMRDEC FMO, Bldg. 5400 Redstone Arsenal, AL 35898 Stop Buzzer: 256-876-1688, DSN: 746-1688
White Sands Missile Range 1	34-20-50 N 106-46-00 W, 34-20-50 N 106-09-30 W, 32-24-00 N 106-09-00 W, 32-21-30 N 106-30-00 W, 32-52-00 N 106-45-00 W	Whites Sands Missile Range DoD Area Frequency Coordinator ATTN SAIS-AOS-W White Sands Missile Range, NM 88002-5526 Stop Buzzer: Primary 505-678-5417/3402 DSN: 258-5417/3402 Alternate 1: 575-678-1193 DSN: 258-1193 Alternate 2: 575-678-0123 DSN: 258-0123
White Sands Missile Range 2	32-40-00 N 106-00-00 W, 32-32-30 N 105-32-30 W, 32-00-00 N 105-57-30 W, 32-00-00 N 106-17-30 W, 32-05-00 N 106-17-30 W, 32-05-00 N 106-35-00 W, 32-20-00 N 106-35-00 W, 32-20-00 N 106-05-00 W	Whites Sands Missile Range DoD Area Frequency Coordinator ATTN SAIS-AOS-W White Sands Missile Range, NM 88002-5526 Stop Buzzer: Primary 505-678-5417/3402 DSN: 258-5417/3402 Alternate 1: 575-678-3311, DSN: 258-3311 Alternate 2: 575-678-1193, DSN: 258-1193

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Army Test and Evaluation Center, Yuma Proving Ground	33-17-28 N 113-38-51 W, 32-52-51 N 113-38-55 W, 32-45-23 N 113-58-13 W, 32-46-07 N 114-36-31 W, 33-33-42 N 114-35-13 W, 33-33-13 N 114-11-58 W, 33-33-13 N 114-11-58 W, 33-01-24 N 114-16-04 W, 33-01-54 N 113-45-05 W, 33-17-28 N 113-45-05 W	Yuma Proving Ground Army Test and Evaluation Center TEDT-YPY-RO 301 C Street Yuma Proving Ground Yuma, AZ 85365-9498 Stop Buzzer: 928-328-3333/2047 DSN: 899-3333/2047
Fort Huachuca	31-19-56 N 109-46-30 W, 31-25-06 N 109-56-02 W, 31-28-02 N 109-56-18 W, 31-42-54 N 109-48-12 W, 31-51-57 N 109-56-51 W, 32-08-19 N 110-00-29 W, 32-20-51 N 110-03-28 W, 32-24-00 N 110-09-39 W, 31-45-01 N 110-28-32 W, 31-44-59 N 110-35-41 W, 31-54-26 N 110-43-23 W, 31-43-47 N 110-51-39 W, 31-34-30 N 110-50-56 W, 31-23-59 N 110-45-04 W, 31-20-04 N 110-45-04 W	Fort Huachuca DoD Area Frequency Coordinator ATTN: SFIS-FAC-SH Fort Huachuca, AZ 85613-6000 Stop Buzzer: Primary 520-538-4903 Cell: 520-266-0459 Alternate: 602-538-6423 or 6424

### C.1.3 United States Coast Guard

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
U.S. Coast Guard Research and Development Center	41-21-17 N 072-05-32 W, 41-21-19 N 072-04-57 W, 41-20-16 N 072-04-43 W, 41-20-11 N 072-05-59 W, 41-20-58 N 072-06-00 W	U.S. Coast Guard Research and Development Center 1 Chelsea Street New London, CT 06320 Stop Buzzer: 860-271-2834
Coast Guard Academy	41-22-15 N 072-06-12 W 0.5 km radius	Coast Guard Academy Department of Engineering New London, CT 06320 Stop Buzzer: 860-444-8527
Field Testing and Development Center	39-11-52 N 076-34-15 W 1 km radius	Field Testing and Development Center Coast Guard Yard 2401 Hawkins Point Rd. Baltimore, MD 21226-5000 Stop Buzzer: 410-636-3797
Telecommunications and Information Systems Command	38-48-00 N 077-04-43 W 0.5 km radius	Coast Guard Telecommunications and Information Systems Command Alexandria, VA 22315 Stop Buzzer: 703-313-5561 (Duty Hours), 703-313-5400 (Off-Duty Hours)



### C.1.4 Department of Commerce

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Boulder Labs Campus	39-59-25 N 105-16-05 W, 39-59-25 N 105-15-33 W, 39-59-47 N 105-15-42 W, 39-59-46 N 105-15-49 W, 39-59-37 N 105-16-08 W, 39-59-25 N 105-16-05 W	Attention: Frequency Coordinator 325 Broadway, ITS.E, Boulder, CO 80305 Fax: 303-497-6982 Stop Buzzer: 303-497-4619
Table Mountain Observatory	40-08-02 N 105-14-40 W 1 km radius	Attention: Frequency Coordinator 325 Broadway, ITS.E Boulder, CO 80305 Fax: 303-497-6982 Stop Buzzer: 303-497-4619
NOAA/NWS, Sterling VA	38-58-19 N 077-29-20 W, 38-58-20 N 077-29-15 W, 38-58-24 N 077-29-17 W, 38-58-23 N 077-29-22 W, 38-58-19 N 077-29-20 W	Attention: Forecast Operations 43741 Weather Service Road Sterling, VA 20166 Fax: 703-471-1374 Stop Buzzer: 703-661-1268/1293
Los Alamos National Laboratory	35-52-51 N 106-18-42 W 3.2 km radius	Los Alamos National Laboratory Los Alamos, NM 87115 Telephone: 702-295-4766 or 702-734-3343 (nights and holidays) Fax: 702-295-3428 Stop Buzzer: 505-665-7673 (Primary) or 702-295-4766 (Alternate)
Lawrence Livermore National Laboratory/Sandia National Laboratory Area 1	37-39-06 N 121-31-59 W 0.8 km radius	Lawrence Livermore National Laboratory/Sandia National Laboratory Livermore, CA 94551 Telephone: 702-295-4766 or 702-734-3343 (nights and holidays) Fax: 702-295-3428 Stop Buzzer: 925-423-9355 (Primary) or 702-295-4766 (Alternate)
Lawrence Livermore National Laboratory/Sandia National Laboratory Area 2	37-40-47 N 121-42-38 W 0.5 km radius	Livermore, CA 94551 Telephone: 702-295-4766 or 702-734-3343 (nights and holidays) Fax: 702-295-3428 Stop Buzzer: 925-423-9355 (Primary) or 702-295-4766 (Alternate)
Nevada Nuclear Security Site	37-20-00 N 116-35-00 W, 37-20-00 N 115-55-00 W, 36-41-00 N 115-55-00 W, 36-41-00 N 116-35-00 W	Nevada Nuclear Security Site (formerly Nevada Test Site) Mercury, NV 89023 Telephone: 702-295-4766 or 702-734-3343 (nights and holidays) Fax: 702-295-3428 Stop Buzzer: 702-295-4766
Nevada Operations Office Location 1	36-12-36 N 115-08-29 W 0.1 km radius	Nevada Operations Office Las Vegas, NV 89114 Telephone: 702-295-4766 or 702-734-3343 (nights and holidays) Fax: 702-295-3428 Stop Buzzer: 702-295-4766

### C.1.5 Department of Energy

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Nevada Operations Office Location 2	36-14-41 N 115-01-51 W 0.8 km radius	Nevada Operations Office Las Vegas, NV 89114 Telephone: 702-295-4766 or 702-734-3343 (nights and holidays) Fax: 702-295-3428 Stop Buzzer: 702-295-4766
Pacific Northwest National Laboratory (Main Campus)	46-20-52 N 119-16-42 W 1 km radius	Pacific Northwest National Laboratory 902 Battelle Boulevard Richland, WA 99354 Telephone: 509-371-6222 or 509-375-2400 (24/7, nights, holidays and weekends) Stop Buzzer: 509-371-6222 (Primary) or 509-371-2400 (Alternate)
Pacific Northwest National Laboratory (North Campus)	46-21-57 N 119-16-48 W .3 km radius	Pacific Northwest National Laboratory 902 Battelle Boulevard Richland, WA 99354 Telephone: 509-371-6222 or 509-375-2400 (24/7, nights, holidays and weekends) Stop Buzzer: 509-371-6222 (Primary) or 509-371-2400 (Alternate)
Pacific Northwest National Laboratory (South Campus)	46-19-10 N 119-16-56 W .3 km radius	Pacific Northwest National Laboratory 902 Battelle Boulevard Richland, WA 99354 Telephone: 509-371-6222 or 509-375-2400 (24/7, nights, holidays and weekends) Stop Buzzer: 509-371-6222 (Primary) or 509-371-2400 (Alternate)
Pacific Northwest National Laboratory (Marine Science Laboratory)	48-04-39 N 123-02-47 W .5 km radius	Pacific Northwest National Laboratory 1529 W Sequim Bay Road Sequim, WA 98382 Telephone: 509-371-6222 or 509-375-2400 (24/7, nights, holidays and weekends) Stop Buzzer: 509-371-6222 (Primary) or 509-371-2400 (Alternate)
Savannah River National Laboratory	33-13-48 N 081-34-50 W 5 km radius	Savannah River National Laboratory Bldg. 773-A, Aiken, SC 29808 Telephone: 803-646-0047 or 803-645-2193 Stop Buzzer: Savannah River Emergency Operations Center, 803-725-1911 (24/7, nights, holidays and weekends)
Sandia National Laboratory	35-03-40 N 106-32-03 W 0.3 km radius	Sandia National Laboratory Albuquerque, NM 87115 Telephone: 505-845-8028 Fax: 702-295-3428 Stop Buzzer: 505-845-8028 (Primary) or 702-295-4766 (Alternate)
Idaho National Laboratory	43-43-19 N 112-45-51 W 30 km radius	Idaho National Laboratory Idaho Falls, ID 83415 Telephone: 208-526-1145 or 208-526-1515 (nights and holidays) Stop Buzzer: 208-526-1145 (Primary) or 208-520-2792 (Alternate) 208-526-1515 (24/7, Nights, holidays and weekends)

### C.1.6 Department of Justice

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
FBI Engineering Research Facility	38-31-54 N 077-26-50 W 1 km radius	Engineering Research Facility Building, 27958A Quantico, VA 22135 Attention: Radio Systems Development Unit Telephone: 703-985-6705 Fax: 703-985-6694 Stop Buzzer: 571-641-6756
DEA Office of Investigation Technology	38-40-16 N 077-14-26 W 1 km radius	DEA Office of Investigation Technology 10555 Furnace Road Lorton, VA 22079 Telephone: 703-495-6755 Fax: 703-695-6542 Stop Buzzer: 571-220-4587

### C.1.7 Federal Aviation Administration

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
William J. Hughes Technical Center	39-28-27 N 074-34-24 W, 39-28-18 N 074-35-06 W, 39-28-24 N 074-35-12 W, 39-27-45 N 074-36-45 W, 39-26-34 N 074-35-56 W, 39-26-74 N 074-34-50 W, 39-25-52 N 074-33-35 W, 39-26-09 N 074-32-27 W, 39-27-01 N 074-32-22 W	Atlantic City International Airport Bldg. 300 Atlantic City, NJ 08405 Telephone: 609-485-5436 Fax: 609-485-5113 Stop Buzzer: 703-326-3873 at FAA National Operations Control Center (NOCC)
Mike Monroney Aeronautical Center	35-25-22 N 097-38-10 W, 35-25-22 N 097-37-03 W, 35-22-36 N 097-37-03 W, 35-22-36 N 097-38-10 W	6500 South MacArthur Boulevard Oklahoma City, OK 73125 Telephone: 405-954-7922 Fax: 405-954-3188 Stop Buzzer: 703-326-3873 at FAA National Operations Control Center (NOCC)

### C.1.8 Federal Communications Commission

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Equipment Development Group	33-51-53 N 084-43-24 W 0.5 km radius	Enforcement Bureau 3600 Hiram-Lithia Springs Rd. Hiram, GA 30141-6370 Fax: 770-943-9793 Stop Buzzer: 770-222-4220

Laboratory Division	39-10-04 N 076-49-37 W 0.5 km radius	Office of Engineering and Technology 7435 Oakland Mills Road Columbia, MD 21046 Fax: 301-362-3290 Stop Buzzer: 301-362-3000
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### C.1.9 Health and Human Services

Site Name	Operating Area (Latitudes- Longitudes in Degrees- Minutes-Seconds)	Point-of-Contact
Food and Drug Administration	39-02-07 N 076-58-59 W 0.3 km radius	10903 New Hampshire Avenue Silver Spring, MD 20993-0002 Stop Buzzer: 866-300-4374

### C.1.10 Department of Homeland Security

Site Name	Operating Area (Latitudes- Longitudes in Degrees- Minutes-Seconds)	Point-of-Contact
Department of Homeland Security Science and Technology Testing Directorate	400408N, 0751932W Operational radius: 0.3km	14 Union Hill Rd. Conshohocken PA 19428 STOP BUZZER: Telephone: 707-373-0709 Telephone: 202-247-6619

### C.1.11 National Aeronautics and Space Administration

Site Name	Operating Area (Latitudes- Longitudes in Degrees- Minutes-Seconds)	Point-of-Contact
Ames Research Center	37-24-06 N 122-02-15 W, 37-25-06 N 122-02-15 W, 37-25-45 N 122-02-02 W, 37-26-12 N 122-03-14 W, 37-26-10 N 122-04-19 W, 37-25-40 N 122-04-08 W, 37-24-31 N 122-04-07 W	Ames Research Center M/S IO 233-17 Moffett Field, CA 94035-1000 Telephone: 650-604-1415 Stop Buzzer: 650-604-1415
Armstrong Flight Research Center, Area 1	34-36-33 N 118-07-20 W, 34-37-11 N 118-07-18 W, 34-38-43 N 118-06-12 W, 34-38-42 N 118-03-32 W, 34-36-30 N 118-03-31 W	Armstrong Flight Research Center MS 2516 P.O. Box 273 Edwards, CA 93523 Telephone: 661-276-2138 Stop Buzzer: 661-276-3151
Armstrong Flight Research Center, Area 2 (Facility)	34-34-38 N 118-06-53 W 1 km radius	Armstrong Flight Research Center MS 2516 P.O. Box 273 Edwards, CA 93523 Telephone: 661-276-2138 Stop Buzzer: 661-276-3151
Glenn Research Center, Area 1	41-25-05 N 081-51-16 W, 41-25-07 N 081-51-22 W, 41-25-01 N 081-52-06 W, 41-24-31 N 081-52-34 W, 41-24-28 N 081-51-54 W	Glenn Research Center 21000 Brookpark Rd. (MS 54-4) Cleveland, OH 44135 Telephone: 216-433-3457 Stop Buzzer: 216-433-3457

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Glenn Research Center, Area 2	41-22-45 N 082-43-12 W, 41-22-36 N 082-43-12 W, 41-21-53 N 082-42-54 W, 41-21-44 N 082-42-07 W, 41-21-44 N 082-41-41 W, 41-21-36 N 082-41-40 W, 41-20-15 N 082-38-45 W, 41-20-04 N 082-38-45 W, 41-20-03 N 082-38-41 W, 41-20-03 N 082-38-37 W, 41-21-33 N 082-38-39 W, 41-23-02 N 082-39-10 W, 41-23-03 N 082-39-51 W, 41-23-09 N 082-39-52 W, 41-23-09 N 082-39-54 W, 41-23-12 N 082-39-58 W, 41-23-12 N 082-40-08 W, 41-23-17 N 082-40-11 W, 41-23-14 N 082-40-18 W, 41-23-38 N 082-40-35 W, 41-23-40 N 082-40-36 W, 41-23-41 N 082-40-38 W, 41-23-42 N 082-40-40 W, 41-23-42 N 082-40-41 W, 41-23-42 N 082-40-43 W, 41-23-43 N 082-41-29 W, 41-23-42 N 082-41-32 W, 41-23-41 N 082-41-35 W, 41-23-39 N 082-41-37 W, 41-23-08 N 082-42-02 W, 41-22-43 N 082-42-01 W	Glenn Research Center 21000 Brookpark Rd., MS 54-4 Cleveland, OH 44135 Telephone: 216-433-3457 Stop Buzzer: 216-433-3457
Goddard Space Flight Center	38-59-31 N 076-51-41 W, 38-59-30 N 076-51-32 W, 38-59-30 N 076-51-13 W, 38-59-29 N 076-51-02 W, 38-59-27 N 076-50-57 W, 38-59-27 N 076-50-54 W, 38-59-28 N 076-50-38 W, 38-59-32 N 076-50-32 W, 38-59-32 N 076-50-23 W, 38-59-30 N 076-50-15 W, 38-59-28 N 076-50-14 W, 38-59-28 N 076-50-12 W, 38-59-28 N 076-50-11 W, 38-59-28 N 076-50-11 W, 38-59-33 N 076-50-10 W, 38-59-35 N 076-50-08 W, 38-59-38 N 076-50-08 W,	Goddard Space Flight Center Code 450 Greenbelt, MD 20771 Telephone: 301-286-5089 Stop Buzzer: 301-286-5089

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Goddard Space Flight Center	38-59-41 N 076-50-04 W, 38-59-43 N 076-50-03 W, 38-59-45 N 076-50-03 W, 38-59-47 N 076-49-58 W, 38-59-47 N 076-49-56 W, 38-59-47 N 076-49-54 W, 38-59-49 N 076-49-48 W, 38-59-42 N 076-49-45 W, 38-59-42 N 076-49-45 W, 38-59-44 N 076-49-50 W, 38-59-50 N 076-50-04 W, 38-59-56 N 076-50-05 W, 39-00-03 N 076-50-06 W, 39-00-05 N 076-50-07 W, 39-00-07 N 076-50-09 W, 39-00-09 N 076-50-11 W, 39-00-10 N 076-50-14 W, 39-00-12 N 076-50-17 W, 39-00-12 N 076-50-27 W, 39-00-11 N 076-50-36 W, 39-00-11 N 076-50-48 W, 39-00-13 N 076-50-58 W, 39-00-16 N 076-51-23 W, 39-00-08 N 076-51-47 W, 39-00-08 N 076-51-47 W	Goddard Space Flight Center Code 450 Greenbelt, MD 20771 Telephone: 301-286-5089 Stop Buzzer: 301-286-5089
Goldstone Deep Space Communication (Complex), Facility 1	35-25-26 N 116-53-19 W 1 km radius	Goldstone Deep Space Communication (Complex) 93 Goldstone Rd. Ft. Irwin, CA 92310-5097 Telephone: 760-255-8218 Stop Buzzer: 760-255-8230
Goldstone Deep Space Communication (Complex), Facility 2	35-20-15 N 116-52-31 W 1 km radius	Goldstone Deep Space Communication (Complex) 93 Goldstone Rd. Ft. Irwin, CA 92310-5097 Telephone: 760-255-8218 Stop Buzzer: 760-255-8230
Goldstone Deep Space Communication (Complex), Facility 3	35-17-60 N 116-48-17 W 1 km radius	Goldstone Deep Space Communication (Complex) 93 Goldstone Rd. Ft. Irwin, CA 92310-5097 Telephone: 760-255-8218 Stop Buzzer: 760-255-8230
Goldstone Deep Space Communication (Complex), Facility 4	35-14-34 N 116-47-10 W 2 km radius	Goldstone Deep Space Communication (Complex) 93 Goldstone Rd. Ft. Irwin, CA 92310-5097 Telephone: 760-255-8218 Stop Buzzer: 760-255-8230
Jet Propulsion Laboratory	34-12-35 N 118-10-41 W, 34-11-58 N 118-10-41 W, 34-11-59 N 118-10-31 W, 34-11-50 N 118-10-31 W, 34-11-50 N 118-10-17 W, 34-12-18 N 118 10-00 W	Jet Propulsion Laboratory MS 301-450 4800 Oak Grove Dr. Pasadena, CA 91109 Telephone: 818-354-0068 Stop Buzzer: 818-354-9251

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Kennedy Space Center Facility	29-36-24 N 095-08-38 W 0.5 km radius	Kennedy Space Center IT-D1 Kennedy Space Center, FL 32899 Telephone: 321-867-2520 Stop Buzzer: 321-867-2520
Langley Research Center	37-06-42 N 076 20 12 W, 37-03-48 N 076-20-12 W, 37-03-48 N 076-23-00 W, 37-06-42 N 076-23-00 W	Langley Research Center MS 253 Hampton, VA 23681 Telephone: 757-864-3817 Stop Buzzer: 757-864-5500
Johnson Space Center, Area 1	29-33-08 N 095-05-38 W, 29-33-06 N 095-05-35 W, 29-33-03 N 095-05-33 W, 29-33-20 N 095-04-39 W, 29-33-24 N 095-04-35 W, 29-33-29 N 095-04-31 W, 29-33-32 N 095-04-37 W, 29-33-34 N 095-04-40 W, 29-33-40 N 095-04-45 W, 29-33-54 N 095-04-49 W, 29-34-04 N 095-04-52 W, 29-34-13 N 095-04-55 W, 29-34-17 N 095-04-59 W, 29-34-23 N 095-05-15 W, 29-34-30 N 095-05-32 W, 29-34-31 N 095-05-41 W, 29-34-29 N 095-05-50 W, 29-34-26 N 095-05-55 W, 29-34-18 N 095-06-03 W, 29-33-29 N 095-06-30 W, 29-33-28 N 095-06-28 W, 29-33-31 N 095-06-26 W, 29-33-30 N 095-06-23 W, 29-33-27 N 095-06-24 W	Johnson Space Center Code EV Houston, TX 77058 Telephone: 281-483-0124 Stop Buzzer: 281-483-0124
Johnson Space Center, Area 2	29-35-36 N 095-10-12 W, 29-36-35 N 095-10-12 W, 29-36-35 N 095-10-00 W, 29-35-36 N 095-10-00 W	Johnson Space Center Code EV Houston, TX 77058 Telephone: 281-483-0124 Stop Buzzer: 281-483-0124
Johnson Space Center, Area 3 Facility	29-36-13 N 095-08-38 W, 29-36-25 N 095-08-28 W, 29-36-34 N 095-08-43 W, 29-36-22 N 095-08-53 W	Johnson Space Center Code EV Houston, TX 77058 Telephone: 281-483-0124 Stop Buzzer: 281-483-0124

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Stennis Space Center	30-25-17 N 089-37-25 W, 30-24-16 N 089-39-36 W, 30-22-24 N 089-40-14 W, 30-20-48 N 089-39-30 W, 30-20-11 N 089-37-56 W, 30-19-55 N 089-36-52 W, 30-20-05 N 089-35-36 W, 30-20-48 N 089-34-32 W, 30-22-27 N 089-33-60 W, 30-24-13 N 089-34-36 W	Stennis Space Center Code RA40 Stennis Space Center, MS 39259-6000 Telephone: 228-688-1492 Stop Buzzer: 228-688-1975
Marshall Space Flight Center, Location 1	34-39-51 N 086-40-21 W, 34-39-51 N 086-40-21 W, 34-39-56 N 086-40-21 W, 34-39-56 N 086-40-21 W, 34-40-03 N 086-40-20 W, 34-40-04 N 086-39-48 W, 34-39-53 N 086-39-47 W, 34-39-22 N 086-39-49 W, 34-39-14 N 086-39-41 W, 34-39-02 N 086-39-41 W, 34-39-02 N 086-40-02 W, 34-38-49 N 086-40-02 W, 34-38-49 N 086-39-52 W, 34-38-16 N 086-39-53 W, 34-38-09 N 086-39-39 W, 34-38-09 N 086-39-16 W, 34-37-44 N 086-39-16 W, 34-37-39 N 086-39-10 W, 34-37-36 N 086-39-10 W, 34-37-27 N 086-39-17 W, 34-37-26 N 086-39-59 W, 34-37-27 N 086-39-59 W, 34-37-28 N 086-39-59 W, 34-37-28 N 086-39-59 W, 34-37-28 N 086-39-60 W, 34-37-29 N 086-39-60 W, 34-37-31 N 086-40-01 W, 34-37-31 N 086-40-01 W, 34-37-32 N 086-40-02 W, 34-37-33 N 086-40-02 W, 34-37-34 N 086-40-03 W, 34-37-34 N 086-40-03 W, 34-37-34 N 086-40-04 W, 34-37-35 N 086-40-05 W, 34-37-35 N 086-40-06 W, 34-37-36 N 086-40-07 W, 34-37-39 N 086-40-22 W, 34-37-44 N 086-40-31 W, 34-37-44 N 086-40-23 W, 34-37-57 N 086-40-48 W, 34-38-05 N 086-40-48 W, 34-38-05 N 086-40-40 W, 34-38-31 N 086-40-40 W,	Marshall Space Flight Center Building 4200, Room 510B Marshall Space Flight Center, AL 35812 Telephone: 256-544-0130 Stop Buzzer: 256-544-1771



Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Marshall Space Flight Center, Location 1	34-38-31 N 086-40-49 W, 34-38-31 N 086-40-56 W, 34-38-31 N 086-41-03 W, 34-38-31 N 086-41-03 W, 34-38-31 N 086-41-03 W, 34-38-37 N 086-41-03 W, 34-38-45 N 086-41-04 W, 34-38-44 N 086-41-13 W, 34-39-20 N 086-41-15 W, 34-39-20 N 086-40-24 W, 34-39-20 N 086-40-22 W, 34-39-22 N 086-40-22 W, 34-39-26 N 086-40-21 W, 34-39-26 N 086-40-21 W, 34-39-28 N 086-40-21 W, 34-39-31 N 086-40-21 W, 34-39-31 N 086-40-21 W, 34-39-41 N 086-40-21 W, 34-39-44 N 086-40-21W	Marshall Space Flight Center Building 4200, Room 510B Marshall Space Flight Center, AL 35812 Telephone: 256-544-0130 Stop Buzzer: 256-544-1771
Marshall Space Flight Center, Location 2	30-00-58 N 089-55-45 W, 30-00-58 N 089-55-43 W, 30-00-59 N 089-55-42 W, 30-00-59 N 089-55-40 W, 30-00-59 N 089-55-38 W, 30-00-59 N 089-55-37 W, 30-00-59 N 089-55-35 W, 30-00-59 N 089-55-33 W, 30-01-05 N 089-55-30 W, 30-01-14 N 089-55-36 W, 30-01-23 N 089-55-19 W, 30-01-24 N 089-55-17 W, 30-01-27 N 089-55-14 W, 30-01-28 N 089-55-11 W, 30-01-30 N 089-55-09 W, 30-01-31 N 089-55-08 W, 30-01-31 N 089-55-07 W, 30-01-40 N 089-54-58 W, 30-01-54 N 089-54-42 W, 30-01-02 N 089-55-31 W, 30-00-58 N 089-55-33 W, 30-00-58 N 089-55-30 W, 30-01-00 N 089-55-27 W, 30-01-01 N 089-55-28 W, 30-01-03 N 089-55-29 W, 30-01-02 N 089-55-31 W	Marshall Space Flight Center Bldg. 4200, Room 510B Marshall Space Flight Center, AL 35812 Telephone: 256-544-0130 Stop Buzzer: 256-544-1771
Wallops Flight Facility, Area 1	37-56-50 N 075-29-21 W, 37-56-58 N 075-26-49 W, 37-55-00 N 075-28-13 W, 37-55-23 N 075-29-11 W	Wallops Flight Facility Code 569 Wallops Island, VA 23337 Telephone: 757-824-1623 Stop Buzzer: 757-824-1623
Wallops Flight Facility, Area 2	37-53-39 N 075-26-17 W, 37-52-04 N 075-25-08 W, 37-46-19 N 075-32-15 W, 37-51-49 N 075-30-57 W	Wallops Flight Facility Code 569 Wallops Island, VA 23337 Telephone: 757-824-1623 Stop Buzzer: 757-824-1623

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
White Sands Test Facility	32-31-06 N 106-36-02 W 0.5 km radius	White Sands Test Facility P.O. Box 20 Las Cruces, NM 88004 Telephone: 505-524-5774 Stop Buzzer: 575-524-5556

### C.1.12 National Security Agency

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Spectrum Services (multiple sites)	39-06-31 N 076-46-11 W 65 km radius*  *Note: maximum transmit power of 10 Watts.	Spectrum Services 9800 Savage Road Suite 6548 Ft. George G. Meade, MD 20755-6548 Telephone: 301-688-9200 Stop Buzzer: 301-688-9200

### C.1.13 United States Navy

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Naval Surface Warfare Center Dahlgren Division, Naval Support Activity South Potomac Dahlgren	38-21-08 N 077-02-51 W, 38-21-31 N 077-00-35 W, 38-18-02 N 077-03-24 W, 38-17-54 N 077-00-33 W	Naval Surface Warfare Center Dahlgren Division (NSWCDD) Naval Support Activity South Potomac Dahlgren, VA 22448 Stop Buzzer: 540-653-6187, DSN: 312-249-6187 Telephone: 540-653-6919, DSN: 312-249-6919 Telephone: 540-653-8021, DSN: 312-249-8021
Naval Surface Warfare Center Dahlgren Division, Panama City	30-10-32 N 085-45-15 W 0.5 km radius	Naval Surface Warfare Center Dahlgren Division Naval Support Activity Panama City, FL 31407-7018 Stop Buzzer: 850-235-5372/5114 DSN: 436-5372
Naval Surface Warfare Center Carderock Division Acoustic Research Detachment, Bayview ID	48-04-04 N 116-32-00 W 10 km radius	Naval Surface Warfare Center Carderock Division Acoustic Research Detachment 33964 N. Main Avenue Bayview, ID 83803-9750 Stop Buzzer: 208-683-2321
Naval Underwater Warfare Center, Newport RI	41-31-58 N 071-18-31 W 0.5 km radius	Naval Underwater Warfare Center Newport Detachment Newport, RI 02841 Stop Buzzer: 860-694-3408 DSN: 694-3408

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Naval Air Warfare Center Weapons Development China Lake, Land Test Ranges	37-12-00 N 117-20-03 W, 35-34-00 N 116-23-03 W, 35-28-35 N 116-18-48 W, 35-18-45 N 116-18-48 W, 35-07-00 N 116-34-03 W, 35-07-00 N 116-47-48 W, 35-08-50 N 116-48-43 W, 35-06-30 N 116-58-43 W, 34-53-30 N 117-11-53 W, 34-50-20 N 117-32-03 W, 34-48-30 N 117-32-03 W, 34-48-00 N 117-35-03 W,	Naval Air Warfare Center Weapons Development China Lake Land Test Ranges Code 52370MD M/S 3008, 130 Easy Rd China Lake, CA 93555 Stop Buzzer: 760-939-6827/6941 DSN: 437-6827
Naval Research Laboratory, Chesapeake Bay Detachment	38-39-15 N 076-32-15 W, 38-39-15 N 076-31-37 W, 38-39-39 N 076-31-43 W, 38-39-39 N 076-32-15 W	Naval Research Laboratory Chesapeake Bay Detachment 5813 Bayside Road Chesapeake Beach, MD 20732 Stop Buzzer: 301-257-4000
Space and Naval Warfare Systems Center, Point Loma	32-40-58 N 117-15-00 W 0.5 km radius	Space and Naval Warfare Systems Center (Old Name: Naval Ocean Systems Center) 53560 Hull Street San Diego, CA 92152 Stop Buzzer: 619-221-5252, 619-339-2167 Fax: 619-553-5780
Naval Research Laboratory, Washington DC	38-49-26 N 077-01-21 W 2 km radius	Naval Research Laboratory 4555 Overlook Ave. SW Washington, DC 20375 Stop Buzzer: 202-767-2443 DSN: 297-2443
Naval Air Warfare Center Aircraft Division, Patuxent River, MD	38-17-18 N 076-25-00 W 5 km radius	Mid-Atlantic Area Frequency Coordinator Office NAVAIRWARCENACDIV Code 5.2.2.2, Bldg. 2118 230139 Cedar Point Road, Unit 4 Patuxent River, MD 20670-1183 Stop Buzzer: 301-342-9549 DSN: 342-9549 Telephone: 301-342-1194 DSN: 342-1194 Telephone: 301-342-1532 DSN: 324-1532 STU-301-342-1195
Naval Air Warfare Center Aircraft Division, Webster Outlying Field (WOLF) St. Inigoes, MD	38-08-47 N 076-25-41 W 4 km radius	Mid-Atlantic Area Frequency Coordinator Office NAVAIRWARCENACDIV Code 5.2.2.2, Bldg. 2118 230139 Cedar Point Road, Unit 4 Patuxent River, MD 20670-1183 Stop Buzzer: 301-342-9549, DSN: 342-9549 301-342-1194, DSN: 342-1194 301-342-1532, DSN: 324-1532 STU-301-342-1195 Fax: 301-342-1200

Site Name	Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)	Point-of-Contact
Naval Air Warfare Center Weapons Division, Land Test Ranges, China Lake, CA	35-39-19 N 117-39-25 W 5 km radius	Naval Air Warfare Center Weapons Development China Lake Land Test Ranges Code 52370MD M/S 3008, 130 Easy Rd China Lake, CA 93555 Stop Buzzer: 760-939-6827/6941 DSN: 437-6827
Naval Air Warfare Center Weapons Division, Sea test Range Point Mugu, CA	34-06-49 N 119-06-55 W 5 km radius	Naval Air Warfare Center Weapons Development Sea Test Range Code 52370ME Bldg 53A Point Mugu, CA 93042 Stop Buzzer: 805-989-7865/7983/1003 DSN: 351-7865/7983
Midway Research Center, Stafford VA	38-29-52 N 077-22-21 W 0.61 km radius	Midway Research Center 635 Telegraph Rd Stafford, VA 22554 Stop Buzzer: 703-551-1905
Naval Surface Warfare Center Carderock Division, West Bethesda MD	38-58-07 N 077-12-02 W 1 km radius	Naval Surface Warfare Center Carderock Division 9500 MacArthur Blvd West Bethesda, MD 20817 Stop Buzzer: 301-227-1515
Naval Surface Warfare Center Ships Systems Engineering Station, Philadelphia Naval Business Center	39-53-09 N 075-11-07 W 1 km radius	Naval Surface Warfare Center Ship Systems Engineering Station Carderock Division Philadelphia Naval Business Center 5001 South Broad St. Philadelphia, PA 19112-1403 Stop Buzzer: 215-897-7005
Naval Surface Warfare Center South Florida Testing Facility, Dania Beach FL	26-05-32 N 080-06-34 W 1 km radius	Naval Surface Warfare Center South Florida Testing Facility Carderock Division 91 North Beach Rd. Dania Beach, FL 33004-3035 Stop Buzzer: 954-926-4032
Naval Surface Warfare Center- Crane Division, Crane IN	38-52-05 N 086-49-34 W 4 km radius	Naval Surface Warfare Center - Crane Division NSA Crane Naval Base 300 Highway 361 Crane Indiana, 47522 Telephone: 812-854-2391 DSN: 482-2391
Naval Surface Warfare Center- Crane Division, Sullivan IN	39-07-16 N 087-21-35 W 0.550 km radius	Naval Surface Warfare Center - Crane Division Lake Glendora Test Facility 2588 E CR 300 N Sullivan Indiana, 47882 Telephone: 812-268-5992 ext. 228/225 Fax: 812-268-6794
R-6611A Dahlgren Complex, VA	38-21-30 N 077-01-14 W 38-17-30 N 076-55-59 W, 38-15-45 N 076-51-59 W, 38-13-00 N 076-54-34 W, 38-19-15 N 077-01-59 W	Mike Shea: michael.shea2@navy.mil Telephone: 540-653-6187 Rufino Adorno-Avila: rufino.adorno-avila@navy.mil Telephone: 540-653-6919 Margaret Neel: margaret.neel@navy.mil Telephone: 540-653-8021

<b>Site Name</b>	<b>Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)</b>	<b>Point-of-Contact</b>
R-6612 Dahlgren Complex, VA	38-17-59 N 077-02-14 W 2.13 km radius, and 38-18-23 N 077-02-56 W 2.13 km radius	Mike Shea: michael.shea2@navy.mil Telephone: 540-653-6187 Rufino Adorno-Avila: rufino.adorno-avila@navy.mil Telephone: 540-653-6919 Margaret Neel: margaret.neel@navy.mil Telephone: Telephone: 540-653-8021
R-6613A Dahlgren Complex, VA	38-15-45 N 076-51-59 W, 38-13-30 N 076-46-34 W, 38-10-00 N 076-49-59 W, 38-13-00 N 076-54-34 W	Mike Shea: michael.shea2@navy.mil Telephone: 540-653-6187 Rufino Adorno-Avila: rufino.adorno-avila@navy.mil Telephone: 540-653-6919 Margaret Neel: margaret.neel@navy.mil Telephone: 540-653-8021
Naval Surface Warfare Center Carderock Division Acoustic Southeast Alaska Acoustic, Measurement Facility, Ketchikan AK	55-32-00 N 131-43-00 W 15 km radius	Naval Surface Warfare Center Carderock Division Southeast Alaska Acoustic Measurement Facility 1 Back Island Ketchikan, AK 99901-5637 Stop Buzzer: 907-247-6289
Pacific Missile Range Facility, Kauai HI	22-02-00 N 159-47-00 W, 23-47-00 N 158-15-00 W, 25-41-00 N 161-36-00 W, 23-57-00 N 160-41-00 W, 22-56-00 N 161-49-00 W, 22-45-00 N 161-25-00 W, 22-05-00 N 161-35-00 W, 21-33-00 N 159-33-00 W, 22-00-00 N 160-21-00 W	Pacific Missile Range Facility Hawaiian Area Kekaha, Kauai, HI 96752 Stop Buzzer: 808-335-4343 DSN: 315-421-6343
Jamesburg California	36-24-09 N 121-38-48 W .5 km radius	Naval Research Lab 635 Telegraph Road Stafford, VA 22554 Stop Buzzer: 703-551-1905

#### **C.1.14 Department of Transportation**

<b>Site Name</b>	<b>Operating Area (Latitudes-Longitudes in Degrees-Minutes-Seconds)</b>	<b>Point-of-Contact</b>
Volpe National Transportation Systems Center	42-21-52 N 071-05-13 W 0.25 km radius	Kendall Square Cambridge, MA 02142 Attention: RTV-71 Stop Buzzer: 617-494-2000
Transportation Technology Center Frequency Coordination Office	38-21-52 N 104-28-10 W, 38-21-51 N 104-11-15 W, 38-30-20 N 104-11-05 W, 38-30-23 N 104-28-05 W	Transportation Technology Center AAR Frequency Coordination Office 55500 DOT Rd. Pueblo, CO 81001 Telephone: 719-584-0578 Email: coordination@aar.com

**(Last Page in Annex C)**

## **Annex D**

### **Procedure for Field Level Selection and Coordination of the Use of Radio Frequencies**

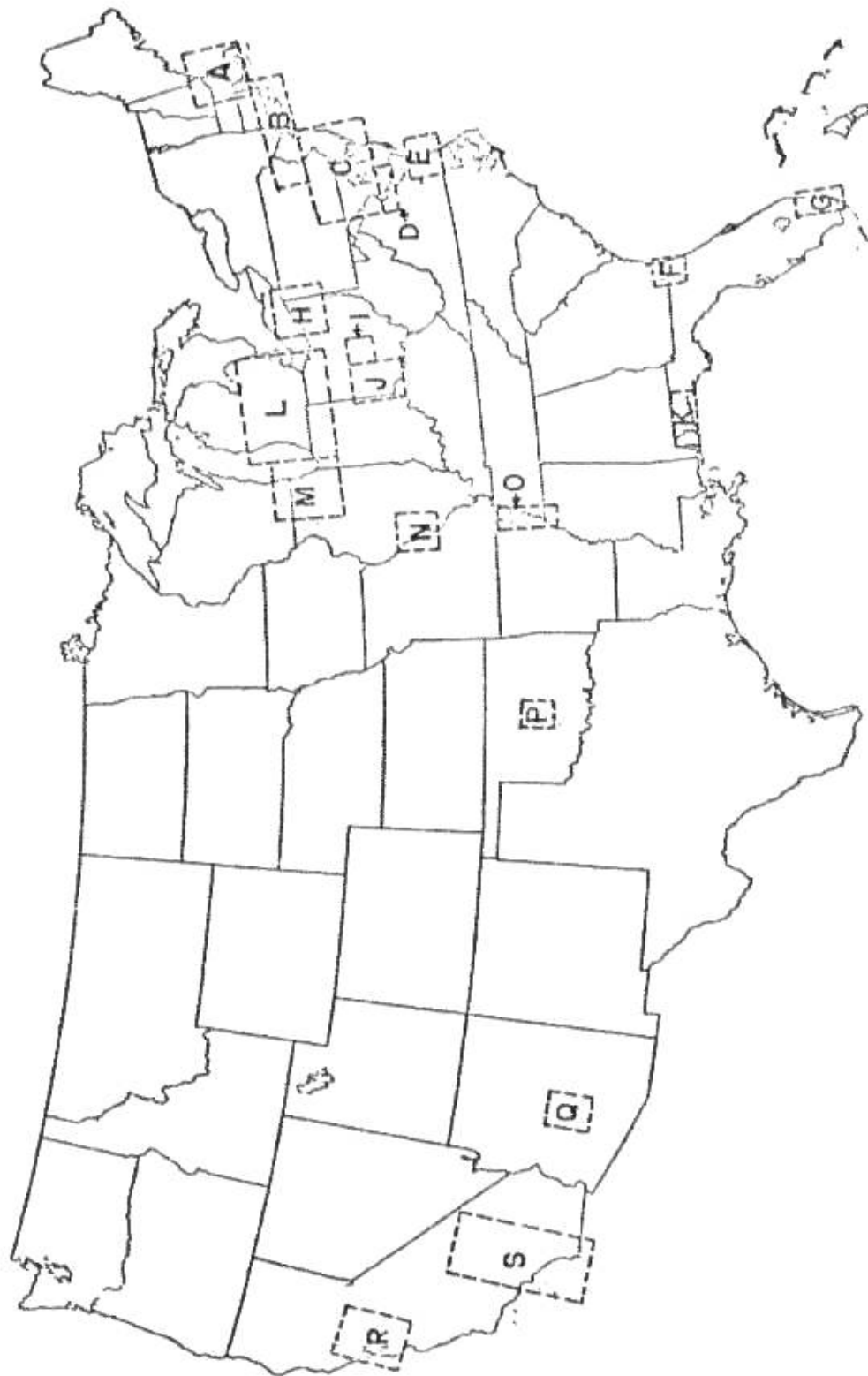
1. This annex contains information for selection and coordination of radio frequencies.
2. Coordination of Aeronautical Advisory Group (AAG) and Radar Bands (1030 MHz, 1090 MHz, 1215-1390 MHz, 2700-2900 MHz, and 9000-9200 MHz) and Air Traffic Control frequencies in the Military Advisory Group (MAG) bands (225-328.6 and 335.4-399.9 MHz) must be completed with the FAA. The coordination of unclassified frequencies will be done through the FAA WebFCR portal located at <https://webfcr.faa.gov>. If there are questions or for assistance using this system, contact the System Administrator at 202-267-9018. WebFCR is for unclassified radio frequency applications requiring FAA coordination in the following frequency bands.

190-285 kHz	978-1020 MHz
285-435 kHz	1030 MHz
510-535 kHz	1031-1087 MHz
74.800-75.200 MHz	1090 MHz
108.000-121.9375 MHz	1104-1146 MHz
123.5875-128.8125 MHz	1157-1213 MHz
132.0125-137.000 MHz	1215-1390 MHz
328.600-335.400 MHz	2700-2900 MHz
5000-5250 MHz	9000-9200 MHz

In the 225-328.6 and 335.4-399.9 MHz bands, FAA coordination is required for the Department of Defense if use will impact Air Traffic Control allocated channels. Military Advisory Group (MAG) approval is required for non-Federal and experimental applications, prior to submission to FAA.

For classified requests, please contact the FAA FAS representative and/or submit to FAA-Spectrum@faa.sgov.gov.

**Figure 1: Designated Heavily Used Area in the 2700-2900 MHz Band**





**Table 1: Designated Heavily Used Areas**

<b>Table 1: Designated Heavily Used Areas</b>		
Area	Latitude	Longitude
A	41-30-00	69-45-00
	43-15-00	69-45-00
	43-15-00	72-00-00
	41-30-00	72-00-00
B	40-30-00	71-30-00
	41-30-00	71-30-00
	41-30-00	76-00-00
	40-30-00	76-00-00
C	38-30-00	74-00-00
	40-30-00	74-00-00
	40-30-00	77-45-00
	38-30-00	77-45-00
D	38-00-00	76-00-00
	38-30-00	76-00-00
	38-30-00	77-45-00
	38-00-00	77-45-00
E	36-30-00	75-15-00
	37-30-00	75-15-00
	37-30-00	76-45-00
	36-30-00	76-45-00
F	30-00-00	81-20-00
	31-00-00	81-20-00
	31-00-00	82-20-00
	30-00-00	82-20-00
G	25-00-00	80-00-00
	26-30-00	80-00-00
	26-30-00	80-45-00
	25-00-00	80-45-00
H	40-45-00	80-00-00
	42-20-00	80-00-00
	42-20-00	82-00-00
	40-45-00	82-00-00
I	39-30-00	82-30-00
	40-20-00	82-30-00
	40-20-00	83-30-00
	39-30-00	83-30-00
J	38-45-00	83-30-00
	40-20-00	83-30-00
	40-20-00	85-00-00
	38-45-00	85-00-00
K	30-15-00	86-00-00
	31-00-00	86-00-00
	31-00-00	88-00-00
	30-15-00	88-00-00
L	41-00-00	82-40-00
	43-40-00	82-40-00
	43-40-00	87-00-00
	41-00-00	87-00-00
M	41-00-00	87-00-00
	43-00-00	87-00-00
	43-00-00	89-30-00
	41-00-00	89-30-00

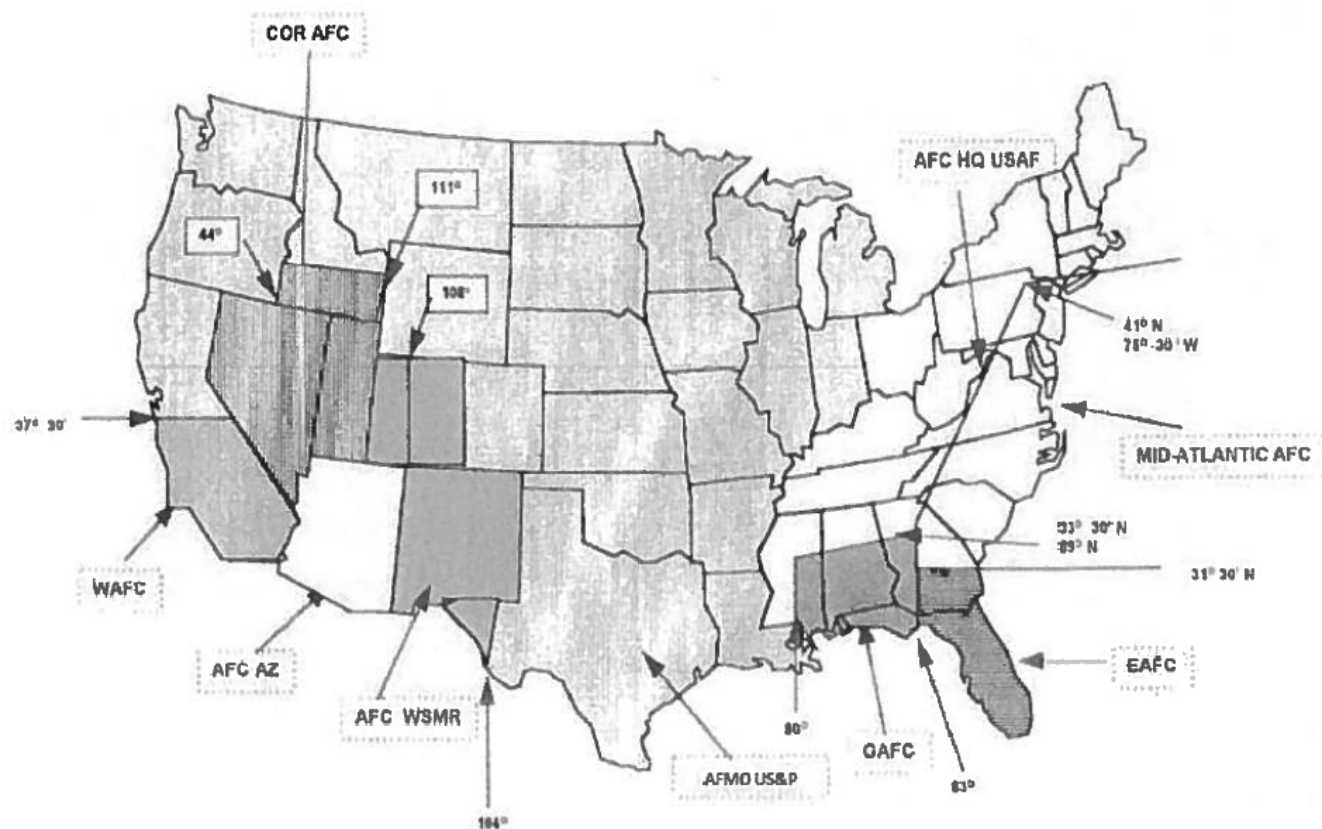
N	38-15-00	89-40-00
	39-30-00	89-40-00
	39-30-00	91-00-00
	38-15-00	91-00-00
O	34-40-00	89-40-00
	36-30-00	89-40-00
	36-30-00	90-30-00
	34-40-00	90-30-00
P	35-00-00	97-00-00
	36-00-00	97-00-00
	36-00-00	98-00-00
	35-00-00	98-00-00
Q	33-00-00	111-30-00
	34-20-00	111-30-00
	24-20-00	112-40-00
	33-00-00	112-40-00
R	37-00-00	121-00-00
	39-00-00	121-00-00
	39-00-00	123-00-00
	37-00-00	123-00-00
S	32-15-00	116-30-00
	36-20-00	116-30-00
	36-20-00	118-14-00
	32-15-00	118-45-00

**Table 2: Federal/Non-Federal Field Level Coordination for the Bands 1435-1525, 2310-2320, and 2345-2395 MHz**

Table 2: Federal/Non-Federal Field Level Coordination for the Bands 1435-1525, 2310-2320, and 2345-2395 MHz		
Federal: Area Frequency Coordinators, geographical area of responsibility, and applicable C-Notes		
Office	Area	C-Notes (see Annex A)
DOD Western Area Frequency Coordinator (WAFC) 130 Easy RoadStop, 3008 Bldg. 31454, Room 230 China Lake, CA 93555-6109 COM: (760) 939-6832 DSN: 437-6832 COM STE: (760) 939-0384 DSN STE: 437-0384 COM FAX: (760) 939-0384 DSN FAX: 437-0384	California south of 37°30'N, including all offshore islands	C003
DoD Area Frequency Coordinator (NAFC) 99 CS/NAFC 5870 Devlin Drive, Suite 120 Nellis AFB, NV 89191-7075 COM: (702) 679-0607 DSN: 679-0607 NIPR Email: <a href="mailto:dodafc@nellis.af.mil">dodafc@nellis.af.mil</a> SIPR Email: <a href="mailto:usaf.nellis.99-abw.mbx.dod-afc-org@mail.smil.mil">usaf.nellis.99-abw.mbx.dod-afc-org@mail.smil.mil</a>	Nevada; Utah west of 111°W; Idaho south of 44°N	C068
DoD Area Frequency Coordinator State of Arizona (AFC-AZ) Bldg. #85846, 2101 Arizona St. Ft. Huachuca, AZ 85616-7043 COM: (520) 538-6423 DSN: 879-6423	Arizona	C009
DoD Area Frequency Coordinator White Sands Missile Range (AFC WSMR) Building 124, Room 330 White Sands Missile Range, NM 88002-5526 COM: (575) 678-5417 DSN: 258-5417 NIPR Organizational Email: <a href="mailto:dod@wsmr.army.mil">dod@wsmr.army.mil</a> <a href="mailto:usarmy.wsmr.imcom-central.list.dodafc@mail.mil">usarmy.wsmr.imcom-central.list.dodafc@mail.mil</a>	Entire state of New Mexico, Texas west of 104°W and the areas of Utah and Colorado between 108°W and 111°W.	C007
Army Frequency Management Office Continental U.S. and Possessions (AFMO US&P) 2350 Stanley Road, Suite 32 JBSA Ft. Sam Houston, TX 78234-2720 COM: (210) 221-0454/2050 DSN: 471-0454/2050 COM FAX: (210) 221-2844 NIPR Organizational Email: <a href="mailto:usarmy.jbsa.mbx.afmo-conus@mail.mil">usarmy.jbsa.mbx.afmo-conus@mail.mil</a>	Arkansas; California north of 37°30' N; Colorado east of 108°W; Idaho north of 44°N; Illinois; Indiana; Iowa; Kansas; Louisiana west of 90°W; Michigan; Minnesota; Missouri; Montana; North Dakota; Oklahoma; Oregon; South Dakota; Texas east of 104°W; Wisconsin, Wyoming.	C024
DoD Gulf Area Frequency Coordinator (GAFC) 201 W. Eglin Blvd., Ste. 207 Eglin AFB, FL 32542-6829 COM: (850) 883-5982 DSN: 875-5982 COM FAX: (850) 882-1244 DSN: 872-1244	Alabama south of 33°30'N; Florida west of 83°W; Georgia west of 83°W, south of 33°30'N; Louisiana east of 90°W; Mississippi east of 90°W, south of 33°33'N and north of 24°00'N	C011
DoD Eastern Area Frequency Coordinator (EAFC) 14820 Samuel C Phillips Pkwy	Florida east of 83°W and north of 24°N; Georgia east of 83°W and south of 31° 30 minutes	C005

Cape Canaveral AFS, FL 32925 COM: (321) 853-8426 DSN: 467-8426 COM FAX: (321) 853-3388 NIPR Organizational Email: <a href="mailto:45sw.dodeafc@us.af.mil">45sw.dodeafc@us.af.mil</a>	N; Atlantic Ocean south of 31° 30 minutes north and West of 77° W and north of 24° N	
Mid-Atlantic Area Frequency Coordinator (MID-LANT AFC) ATTN: Naval Air Warfare Center Aircraft Division Code 5.2.2.2, Unit 4, Building 2118 Atlantic Test Ranges 23013 Cedar Point Road Patuxent River, MD 20670-1883 COM: (301) 342-9549/1194/1532 DSN: 342-9549/1194/1532 COM FAX: (301) 342-1200 NIPR Organizational Email: <a href="mailto:midlantaftc_paxriver@navy.mil">midlantaftc_paxriver@navy.mil</a>	That area of the eastern United States and the Atlantic Ocean south of 41°N; east of a line starting at the intersection of 41°N and 75°30'W running southwest to the intersection of 33°30'N and 83°W; north of 31°30'; west of 68°40'W	C086
United States Air Force Area Frequency Coordinator (USAF AFC) ATTN: AFSMO/SQA 6910 Cooper Ave. Fort Meade, MD 20755-7088 COM: (301) 225-3719 DSN: 375-3719 FAX COM: (301) 225-0583	Alabama north of 33°30'N; Connecticut; Kentucky; Maine; Massachusetts; Mississippi less east of 90°W, south of 33°30'N; New Hampshire; New Jersey north of 41°N; Ohio; Rhode Island; Tennessee; Vermont; West Virginia; and those areas of the following states west of the Mid-Atlantic AFC area: Georgia north of 33°30'N; Maryland; North Carolina; Pennsylvania including the north of 41°N; South Carolina; Virginia	C016
Joint Frequency Management Office Alaska Combined Headquarters ANR-ALCOM (CHQ ANR-ALCOM), J64, Suite 310 Elmendorf AFB, AK 99506-2001 COM: (907) 552-8223 COM FAX: (907) 552-8120	322 km radius of Alaska	
Joint Frequency Management Office Pacific HQ US Pacific Command J613 ATTN: J653/JFMOPAC PO Box 64029 Camp H.M. Smith HI 96861-4029 COM: (808) 477-7239/7242 COM FAX: (808) 477-7214	Hawaii and Guam (322 km radius centered around all islands).	C012
HQ USNORTHCOM/N-NC J637 250 S. Peterson Blvd. Suite 120 Peterson AFB, CO 80914-3817 COM: (719) 554-8523 COM FAX: (719) 554-8198 NIPR Organizational Email: <a href="mailto:n-nc.peterson.ncj6.mbx.jfmo-northcom-omb@mail.mil">n-nc.peterson.ncj6.mbx.jfmo-northcom-omb@mail.mil</a>		
Non-Federal: Aerospace and Flight Test Radio Coordinating Council Coordinator.		
616 East 34 <sup>th</sup> Street North Wichita, KS 67219  Telemetry Coordinator – Mr. Wayne Morris (903) 450-5942 VHF/HF Coordinator – Mr. Dan Hankins (316) 249-1860  If no answer, contact Ms. Chriss Brown (ACCT) (316) 821-9516		

**Figure 2: Coordination Zones for the 1435-1535 and 2310-2390 MHz Bands**



**Figure 3: Gulf Area Coordinator Maps**

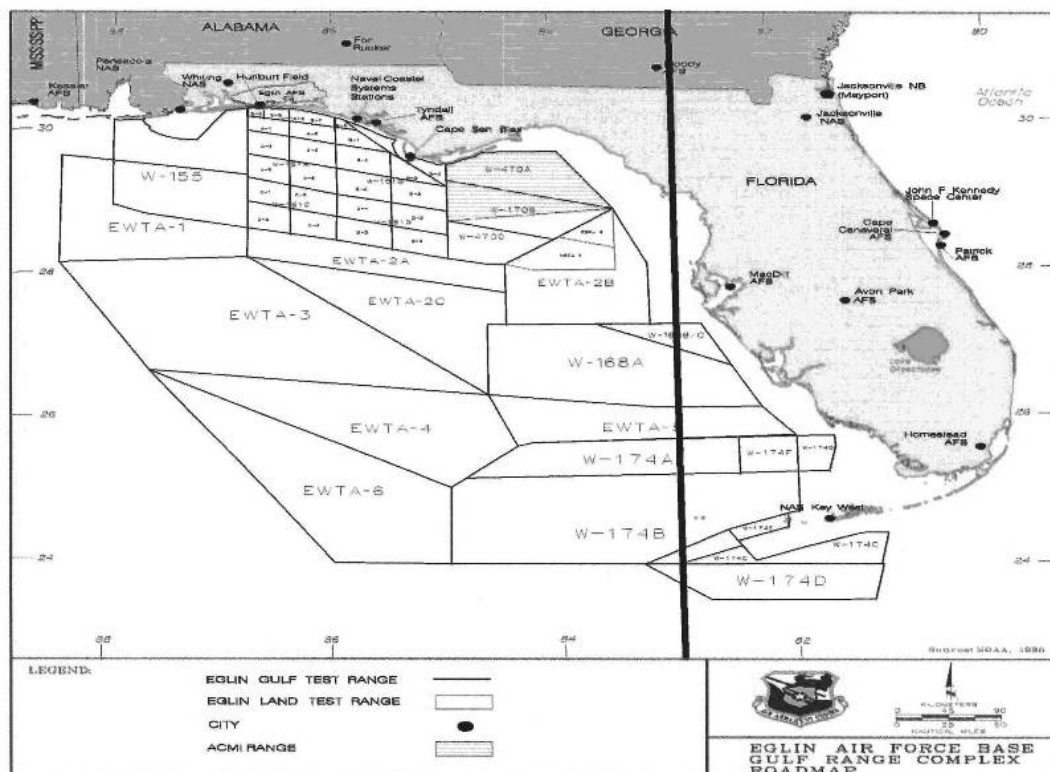
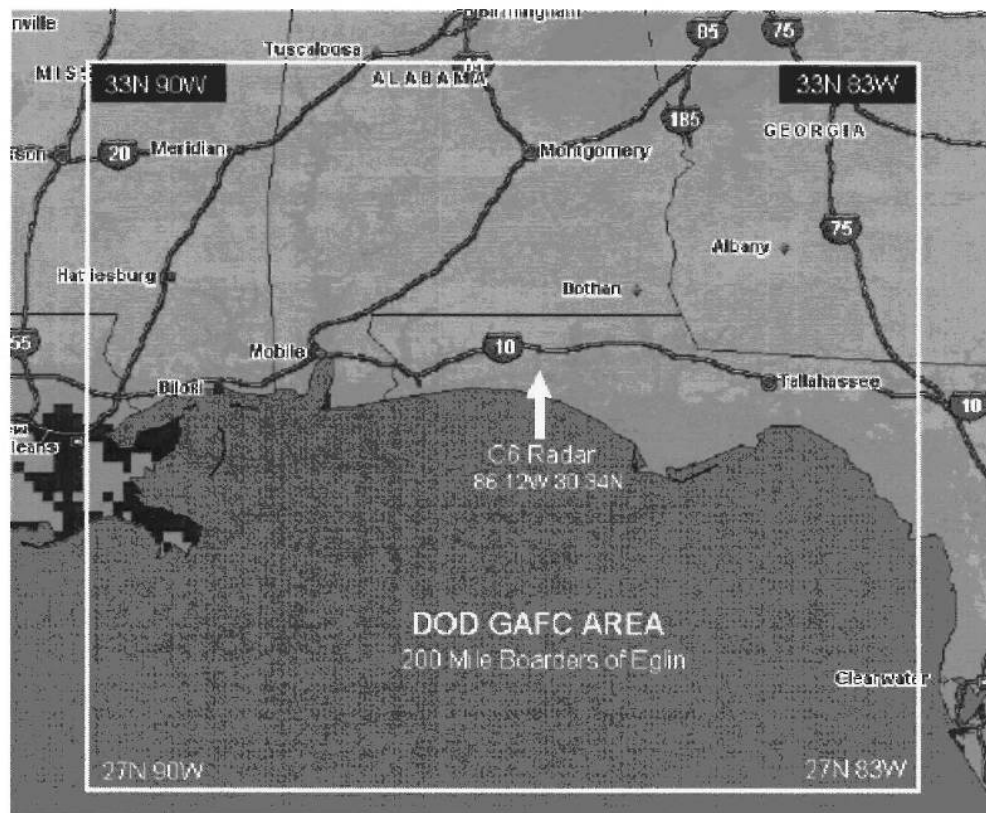


Figure 4. Army Area

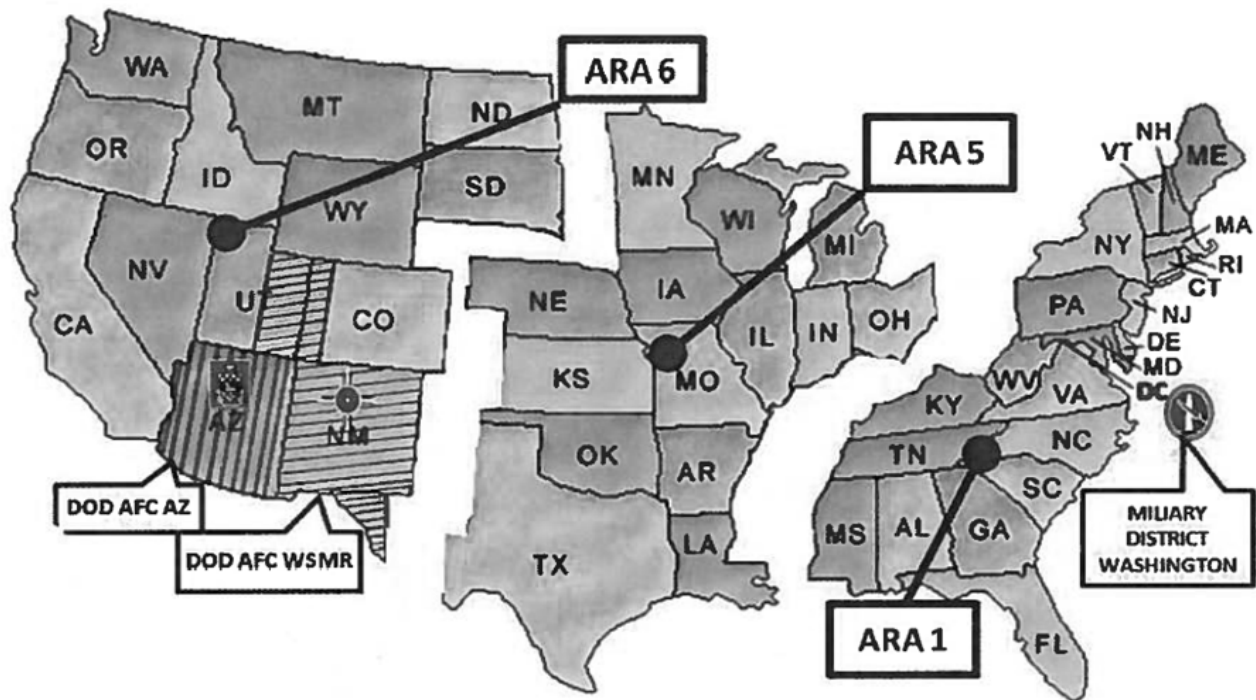
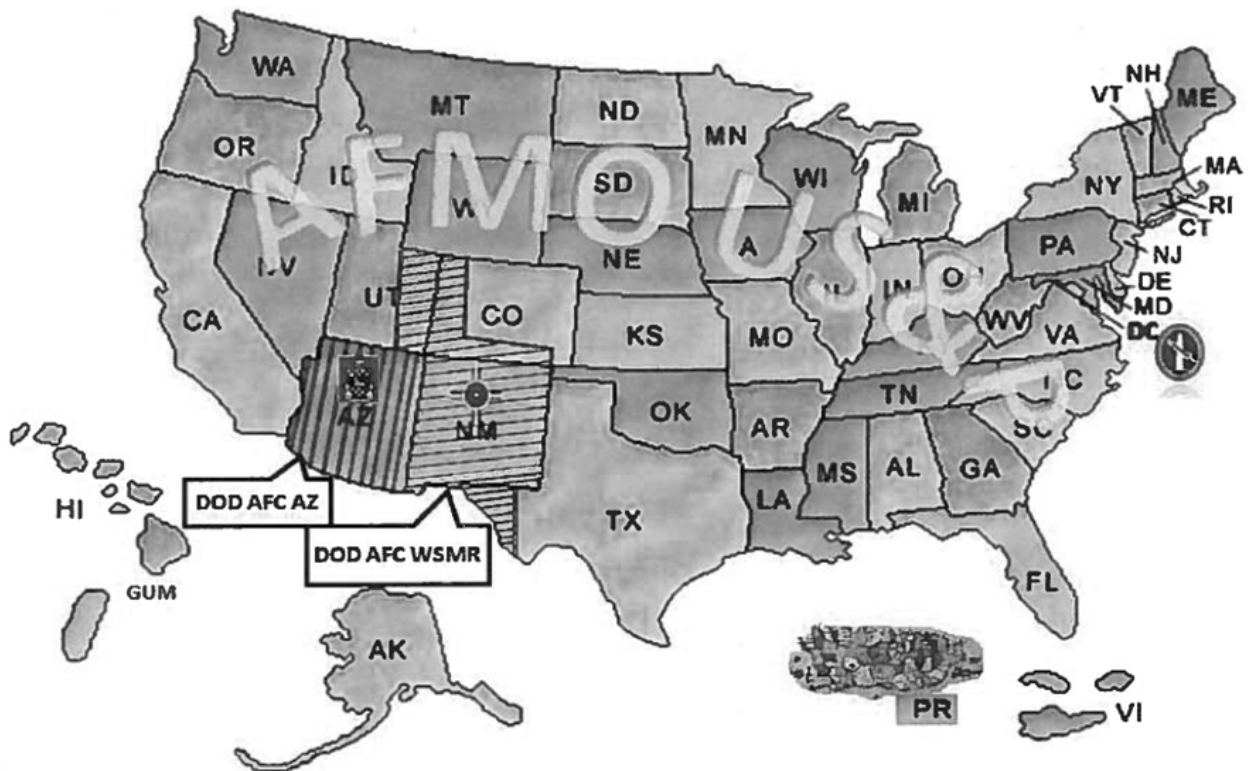


Figure 5 Army Area Frequency Coordinators

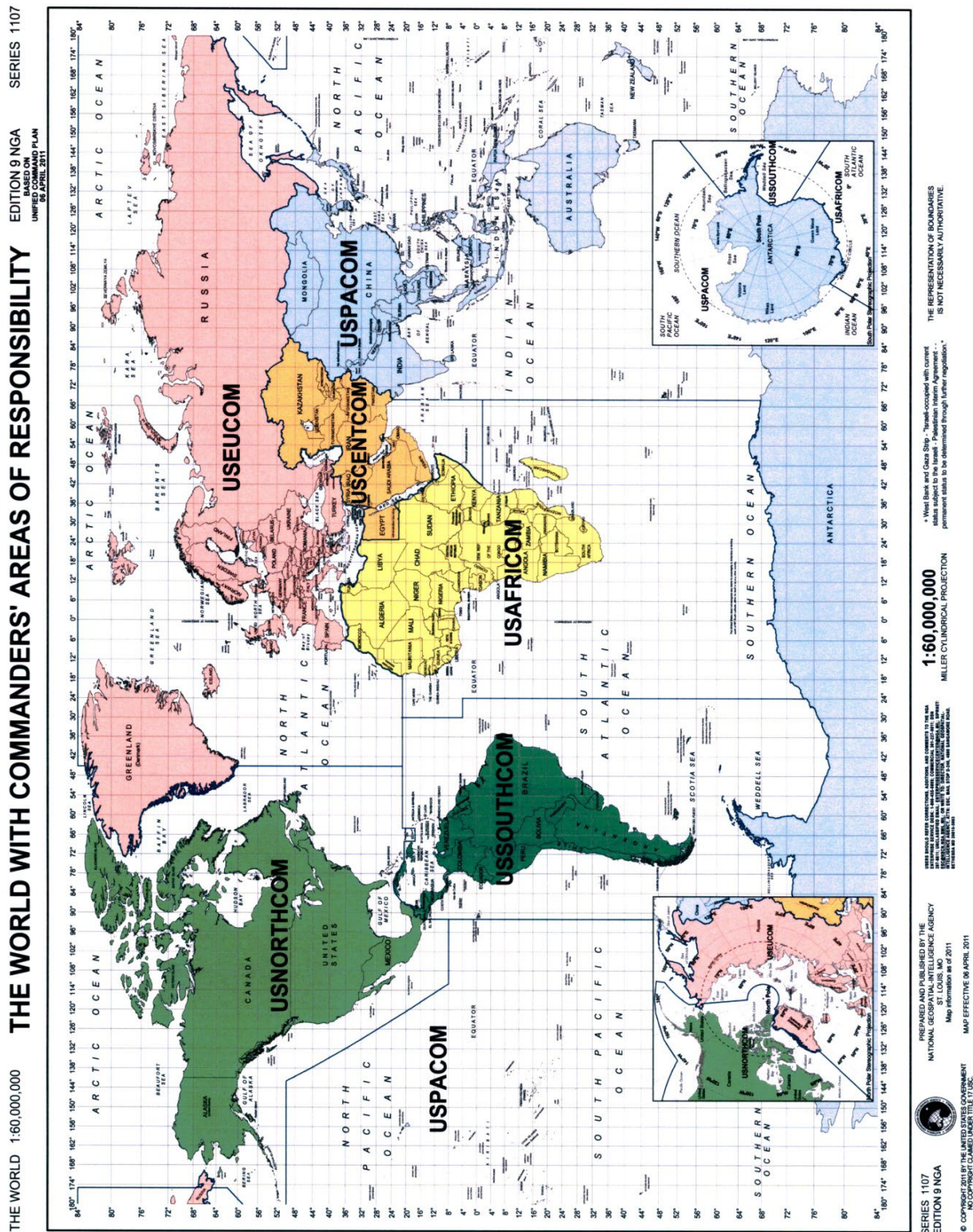


**Table 3: Spectrum Management Areas of Responsibility for Geographic Combatant Commands**

<b>Combatant Commands</b>	<b>Area of Responsibility (see Figure 5)</b>
USNORTHCOM'S	USNORTHCOM'S general geographic area of responsibility (AOR) for the conduct of normal operations is the 48 contiguous states and the District of Columbia (DC), Alaska, Canada, Mexico, the Caribbean Sea and its Island Nations and European possessions (Including Cuba, Puerto Rico, the Virgin Islands, and the Bahamas), and the Atlantic Ocean and its Island Nations and European possessions (excluding Greenland) within the area bounded by the Arctic Ocean from 169° W EAST TO 045° W, SOUTH TO 20° N, WEST TO 064° W, SOUTH TO 17° N, WEST TO 068° W, NORTH TO 21° N, WEST TO 073° W, SOUTHWEST TO 19° N, 075° W, WEST TO 079° W, NORTH TO 20° N, WEST TO MEXICO, SOUTH FROM MEXICO AT 092° W TO 08° N, WEST TO 112° W, NORTHWEST TO 50° N, 142° W, WEST TO 179° W, NORTHEAST TO 63° N, 173° W, NORTHEAST TO 64° N, 169° W, AND NORTH TO 90° N.
USPACOM'S	USPACOM'S general geographic area of responsibility (AOR) for the conduct of normal operations will be the Pacific Ocean from Antarctica at 092° W, NORTH TO 08° N, WEST TO 112° W, NORTHWEST TO 50° N, 142° W, WEST TO 179° W, NORTHEAST TO 63° N, 173° W, NORTHEAST TO 64° N, 169° W, NORTH TO 90° N, THE ARCTIC OCEAN WEST OF 169° W AND EAST OF 100° E, THE INDIAN OCEAN EAST OF 042° E (EXCLUDING THE WATERS NORTH OF 05° S AND WEST OF 068° E AND EXCLUDING THE SEYCHELLES); JAPAN; THE REPUBLIC OF KOREA; THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA; THE PEOPLE'S REPUBLIC OF CHINA; MONGOLIA; THE COUNTRIES OF SOUTHEAST ASIA AND THE SOUTHERN ASIAN LANDMASS TO THE WESTERN BORDER OF INDIA; MADAGASCAR; ANTARCTICA; AND OTHER ISLANDS IN THE ASSIGNED WATER AREAS.



Figure 6: US Combatant Commands Areas of Responsibility



(Last Page in Annex D)



## **Annex E**

### **Guidance for Submission of INMARSAT Commissioning Applications**

#### **E.1 INMARSAT**

1. Established in 1979 to serve the maritime industry by developing satellite communications for ship management and distress and safety applications, Inmarsat currently operates a global satellite system, which is used by independent service providers to offer a range of voice and multimedia communications for customers on the move or in remote locations. While continuing to perform its original mandate, Inmarsat has since expanded into land, mobile and aeronautical communications.

2. On November 1, 1978, the United States Congress added Title V to the Communications Act of 1962. Sections 502(b), 503(a)(1) and 503(a)(3) in Title V stated that the participation of the United States in the INMARSAT Organization. Sections 502 and 503 of the Communications Satellite Act of 1962 ceased to be effective on the date Public Law 106-180 A Orbit Act" was signed on March 17, 2000.

3. On April 15, 1999, Inmarsat, the global mobile satellite communications provider, became the first inter-governmental organization to transition to a private company. Due to this change, agencies can now purchase INMARSAT services through any authorized service provider. To find the service providers for the United States, go to the INMARSAT internet URL, <https://www.inmarsat.com/en/index.html>.

#### **E.2 AGENCY RESPONSIBILITIES**

##### **E.2.1 Agency Representatives**

It is recommended that each federal agency select representatives to act as a central point of contact for commissioning requirements. Agency representatives must assure that the vendor they select can commission the terminal and provide all the service that they will require.

##### **E.2.2 Federal and Agency Regulations**

Any federal organization purchasing an Inmarsat terminal must assure they are in compliance with federal, DOD, and or their agency's regulations concerning the procurement of telecommunications equipment.

##### **E.2.3 Funding Documents**

1. The purchaser must meet the commissioning requirements established by the Land Earth Station Operator (LESO) and or the Inmarsat Service Provider (ISP) and the Accounting Authority. A LESO routes calls beamed from mobiles via satellite to and from terrestrial telephone networks. These organizations are normally the first point of contact locally for anyone seeking to use the Inmarsat satellites. An ISP is an organization that has a contract with one or more LESOs to promote, sell and bill Inmarsat services to end-users. ISPs are likely to be specialized in serving selected markets for Inmarsat products and services. Accounting Authorities are organizations tasked with settling international accounts.

2. Each user should assure funds are set aside to pay for charges accruing at their ISP and at the Accounting Authority who will be settling their international accounts. A valid contract document must be secured, which the service provider can invoice against. This should consist of a purchase order or contract, a basic ordering agreement, a delivery order against a federal contract (i.e., DITCO, GSA), or provision of a Federal Government credit card. Some service providers will require the funding document as part of the activation package. Users of the INMARSAT system incur service charges similar to users of public switched telephone systems. Normally bills will come from the Service Provider (SP) with whom the agency has contracted for services. Service Providers bill their customers for services provided through coast/land earth stations with whom they have contracts both within the United States and in foreign countries. However, a foreign coast/land earth station bills access charges for using its facilities through the Accounting Authority identified in the commissioning documents for each terminal when it does not have an agreement with the terminal's service provider.

3. In the United States, the FCC is an Accounting Authority<sup>1</sup> and has certified several additional entities as Accounting Authorities to settle accounts with foreign telecommunication operators for U.S. vessels. The FCC, however, is the accounting authority of last resort for settling foreign charges; that is, foreign telecommunications operators send the FCC all accounts where the customer has not designated a specific accounting authority. The FCC's International Telecommunications Settlements (ITS) Section in Gettysburg, PA will, therefore, attempt to settle an account from a foreign INMARSAT coast/land earth station when a terminal operator dials its access code rather than the access code of its contractual ISP, unless the operator has an agreement with another Accounting Authority. In cases where an agency expects to use foreign earth stations, the agency representative should make advance financial provisions to settle accounts through the FCC ITS section.

#### **E.2.4 Maritime Mobile Service Identities (MMSI)**

1. A Maritime Mobile Service Identity (MMSI) is required for ship maritime terminals. Information on obtaining an MMSI can be found in Section 6.6.1.

2. If a ship terminal is transferred, replaced, or deactivated, the agency representative must inform the service provider, the accounting authority and NTIA IRAC Secretariat. The authorized "Contract Instrument or Purchase Order" must be revised if the equipment is replaced and deleted if the equipment is deactivated. A new activation package may be needed if the terminal is transferred to another ship.

#### **E.2.5 Procedure for Obtaining Secondary Surveillance Radar (SSR) Mode S Code for Federal Government Aircraft Earth Station Commissioning Applications**

1. Section 1.1.3 of the Aircraft Earth Station application form requires a 24-bit International Civil Aviation Organization (ICAO) technical address and a SSR Mode S Octal Code.<sup>2</sup> This information is obtained from the Federal Aviation Administration (FAA) who is the registering authority for commercial aircraft; the Air Force manages this program for military aircraft. DOD applicants who require an octal code should submit a letter to:

DoD International AIMS Program Office  
380 Richard Ray Blvd., Ste 104  
Robins AFB, GA 31098-1638  
DSN 468-6123, commercial (478) 926-6123, and fax number 5390

The request must contain:

- Point of Contact
- Identification of the aircraft (ex. C-135)
- Aircraft Tail Number
- Name and address of the major command and the unit to which the aircraft is assigned
- Location where the aircraft will be home-based
- Fax telephone number to receive octal code

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<sup>1</sup> If the FCC has to inform the State Department that the charges are returned as "unable to collect" or "unable to locate," the foreign country where the INMARSAT service originated can bar communications to and from the terminal whose bill was not paid. If two countries bar a terminal's communication, it is mandatory that all coast/land earth stations bar that terminal's communications.

<sup>2</sup> The assignment of addresses for military aircraft is not processed in the same manner as those for commercial aircraft. The address for commercial aircraft is derived by using the tail number, however, the tail number is not used to derive a number for military aircraft. The Air Force representative assigns the next available number in the block of addresses provided to the Air Force by the FAA.

2. Non-military federal aircraft registered with the FAA should already have a Mode S Octal Code. Your aircraft maintenance section should be able to supply you with this information. If you are unable to determine the octal code, contact the FAA Aircraft Registration Branch at 405-954-3116. They will require the name and address of your agency, along with the tail number of the aircraft.

**(Last Page in Annex E)**

## Annex F

### Frequency Assignment Review Procedure

#### FREQUENCY ASSIGNMENT REVIEW PROCEDURE

1. The purpose of this procedure is to achieve the objectives stated in Section 8.2.6, paragraph 1, of this Manual. Normally this will be accomplished by reviewing within a given year all frequency assignments that were last reviewed during the previous five to ten years. (The date of the last review of an assignment can be determined by the entry in the REVISION DATE (RVD) field of the assignment record.) Assignment reviews shall be accomplished by the date in RVD plus:

- a. Five years for those assignments not identified in b and c, below.
- b. Ten years for those assignments considered by the Aeronautical Advisory Group (AAG).<sup>1</sup>
- c. Ten years for assignments in which all the space stations are in a geostationary-satellite orbit.
- d. Five years for assignments which include one or more space stations in a non-geostationary satellite

orbit.

2. During the review the agency concerned will determine for each frequency assignment:

- a. Whether the assignment is essential to meet the agency's requirements; and,
- b. if so, whether other existing assignments will meet the requirements; and,
- c. if not, whether the justification for and description of the assignment under review, are still accurate;

and,

- d. if so, whether the assignment is completely up to date,

e. Each federal agency will maintain the contact information of the person who validated that the radio frequency is still in use. This information will include their name and date of verification for each 5 year or 10 year review and will be accessible to the FAS representative.

3. An assignment is completely up to date if it contains in the proper fields all of the particulars required by this Manual. Particular attention will be made to ensure accuracy in parameters of frequency, location (longitude and latitude), transmitter power, antenna height and gain, station classes, emission designator, bandwidth, radius of operation, time usage, pulse width, and pulse repetition rate (for radar systems).

4. Agencies will submit DELETION actions for those assignments that are not qualified for retention under 2a above. Those assignments qualified for retention, but not up to date in accordance with the particulars of this Manual, will be updated by submitting a MODIFICATION or SERIAL REPLACEMENT action using the procedures of Chapter 9.

5. Assignments qualified for retention, and completely up to date in accordance with the particulars of this Manual, will be certified as such by submission of MODIFICATION actions to update the date of last revision. This update is done by using the field code RYR with the last two digits of the current year (e.g., RYR01 00). This result in the data in the GMF field RVD being reset to the year, month and day the revision is approved. (See Section 9.15)

6. Assignments that are not reviewed within the timeframe allowed in accordance with paragraph 1 above, will be changed to add Special Note S400 and expiration date (EXD) of 7 years from the existing REVISION DATE (RVD) for paragraph 1a, or 12 years from the existing RVD for paragraph 1b or 1c.

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<sup>1</sup> Reference Section 1.3.2

**(Last Page in Annex F)**

## Annex G

### Abbreviations

#### G.1 AGENCY, BUREAU, AND OTHER ORGANIZATIONAL ABBREVIATIONS

This section of Annex G contains those agency and other organizational name and bureau abbreviations that will be used in the Serial Number (SER), Bureau (BUR) and Circuit Remarks (REM) fields of the GMF. (See Chapter 9, Section 9.8.2).

Agency	Bureau	Abbreviation
Agency for International Development		AID
Agriculture, Department of		A
	Animal and Plant Health Inspection Service	APHIS
	Agriculture Research Service	ARS
	Cooperative State Research Education & Extension Service	CSRE
	Farm Service Agency	FSA
	Farmers Home Administration	FHA
	Food & Nutrition Service	FNS
	Forest Service	F
	Forest Service - Region 1	F1
	Forest Service - Region 2	F2
	Forest Service - Region 3	F3
	Forest Service - Region 4	F4
	Forest Service - Region 5	F5
	Forest Service - Region 6	F6
	Forest Service - Region 8	F8
	Forest Service - Region 9	F9
	Forest Service - Region 10	F10
	Forest Service - Washington Office	FWO
	Food Safety and Inspection Service	FSIS
	Grain Inspection, Packers & Stockyards Administration	GIPS
	Natural Resources Conservation Service	NRCS
	Office of Inspector General	OIG
	Office of the Secretary	SEC
Air Force, Department of the		AF
Architect of the Capitol		AOTC
Army, Department of the		AR
	AFMO US&P	AC
	United States Army, Alaska	AK
	Army Spectrum Management Office	AR
	Corps of Engineers	CE
	Military District of Washington	DW
	Army Spectrum (Fort Meade)	FM
	AFC, State of Arizona	HU
	U.S. Army (State of Hawaii)	HW
	Satellite/Communications	SAT
	U.S. Army Pacific (does not include Hawaii)	PA
	AFC, White Sands Missile Range	WS
Administrative Office of the United States Courts		AUSC
Commerce, Department of		C
	Bureau of Industry and Security	BIS
	Census Bureau	CEN
	Oceanic and Atmospheric Research	OAR
	International Trade Administration	ITA
	Institute for Telecommunications Science	ITS

Agency	Bureau	Abbreviation
	National Institute of Standards and Technology	NIST
	National Data Buoy Center	NDBC
	National Environmental Satellite, Data, and Information Service	NESS
	National Marine Fisheries Service	NMFS
	Under Secretary's Administrative Offices	USAO
	National Ocean Service	NOS
	National Telecommunications and Information Administration	NTIA
	National Technical Information Service	NTIS
	National Weather Service	NWS
	Office of Marine and Aviation Operations	OMAO
	NOAA Homeland Security Program Office	NHSP
	Patent and Trademark Office	PAT
	Office of Security	SEC
	Office of the Secretary	OSY
Coast Guard	Operating unit identifier is listed in the XRC field	CG
	Number Coast Guard Districts 1 through 17, including sub-units.	01-17
	Numbered Coast Guard Headquarters Units	20-96
	CG Headquarters, Washington, DC	98
Central Intelligence Agency		CIA
Consumer Products Safety Commission		CPSC
Court Services and Offender Supervision		CSOS
Education, Department of		ED
	COOP/COG Activities	COOP
	Office of the Inspector General	OIG
	Office of Protective Services	OPS
Energy, Department of		DOE
	Alaska Power Administration	APA
	Albany Research Center	ARC
	Albuquerque Operations Office Amarillo Area Office Amarillo Pantex Plant Carlsbad Area Office Carlsbad Waste Isolation Pilot Project (WIPP) Dayton Area Office/Grand Junction Office Kansas City Area Office Kansas City Plant Kirtland Area Office Los Alamos Area Office Los Alamos National Lab Lovelace Respiratory Research Institute Sandia National Laboratory, California Sandia National Laboratory, New Mexico (Including all USA/USP assign.) Sandia National Laboratory, Pacific Operations Sandia National Laboratory, Tonopah Test Range, NV Tactical Security Division	AL
	Atlanta Regional Support Office Bartlesville Project Office	ARSO
	Bonneville Power Administration	BPA
	Boston Regional Support Office	BRSO
	Chicago Operations Office Ames Group Ames National Laboratory Argonne Group Argonne National Lab, East	CH



Agency	Bureau	Abbreviation
	Argonne National Lab, West Brookhaven Group Brookhaven National Lab Environmental Measurements Lab Environmental Programs Group Fermi Group Fermi National Accelerator Laboratory MIT Group New Brunswick Laboratory Princeton Group Princeton Plasma Physics Laboratory	
	Chicago Regional Support Office	CRSO
	Denver Regional Support Office	DRSO
	Federal Energy Technology Center Colorado Off-Site Support Office, Golden, Colorado Colorado Support Office, Denver, Colorado Federal Energy Technology Center North, Pittsburgh, Pennsylvania Federal Energy Technology Center South, Morgantown, West Virginia Georgia Support Office, Atlanta, Georgia Illinois Support Office, Chicago, Illinois Kansas City Remote Duty Station, Kansas City, Kansas Massachusetts Support Office, Boston, Massachusetts Montana Operations Office, Butte, Montana National Petroleum Technology Center National Renewable Energy Laboratory, Golden, Colorado National Renewable Energy Laboratory, Washington, DC New York Support Office, New York, New York Pennsylvania Support Office, Philadelphia, Pennsylvania Texas Support Office, Dallas, Texas Washington Support Office, Seattle, Washington Wyoming Operations Office, Gillette, Wyoming	FETC
	Golden Field Office Administration Division Office of Acquisition and Financial Assistance Office of Chief Counsel Office of Management and Administration Office of Laboratory Operations Office of Project Management	GFO
	Headquarters Contract Reform and Privatization Project Office Departmental Representative to the Defense Nuclear Facilities Safety Board Energy Information Administration Office of the Chief Financial Officer Office of the Chief Information Officer Office of the Civilian Radioactive Waste Management Office of Congressional and Intergovernmental Affairs Office of Counterintelligence Office of Defense Programs Office of Economic Impact and Diversity Office of Energy Efficiency and Renewable Energy Office of Environmental Management Office of Environment, Safety, and Health Office of Fissile Materials Disposition Office of Fossil Energy Office of the General Counsel Office of Hearings and Appeals Office of Independent Oversight and Performance	HQ

Agency	Bureau	Abbreviation
	Assurance Office of Inspector General Office of Intelligence Office of Internal Affairs Office of Management and Administration Office of Nonproliferation and National Security Office of Nuclear Energy, Science, and Technology Office of Public Affairs/Office of Science Office of the Secretary of Energy Advisory Board Office of Security and Emergency Operations Office of Worker and Community Transition The Office of Policy	
	Idaho Operations Office Idaho National Engineering and Environmental Laboratory INEL ESNET Connection Spectrum Support for Argonne National Laboratories Spectrum Support for Experimental Station Authorization at INEEL Spectrum Support for Fort Saint Vrain Spectrum Support for the Main M&O Contractor Spectrum Support for Naval Reactor Facility Spectrum Support for West Valley, New York	ID
	National Nuclear Security Administration Office of the Deputy Administrator for Defense Nuclear Non-proliferation Office of the Deputy Administrator for Defense Programs Office of the Deputy Administrator for Naval Reactors	NNSA
	Naval Petroleum Reserves in California Engineering Division/Planning, Analysis, and Program Division Support	NPR
	Naval Petroleum and Oil Shale Reserves in Colorado, Utah, & Wyoming	CO
	Nevada Operations Office Nevada Test Site Joint Test Operations (LANL, LLNL, SNL) Nevada Operations (Nevada Test Site & Las Vegas) Nevada Test Site Development Corp. Nevada Testing Institute, Inc. Pacific Area Operations, Honolulu, Hawaii Remote Sensing Lab, Nellis AFB, NV (Nuclear Emergency Search Team) Special Technologies Lab, Santa Barbara, CA Washington Area Measurements Operations, Washington, DC Yucca Mountain Project, NV	NV
	Oak Ridge Operations Office Cincinnati Operations Office, Cincinnati, Ohio Dallas Operations Office, Dallas, Texas East Tennessee Technology Park Laramie ETC/Oak Ridge Associated Universities Oak Ridge Institute for Science and Education Oak Ridge National Laboratory Oak Ridge Operations Environmental Management Program Oak Ridge Operations Office Federal Building Oliver Springs Area Office, Oliver Springs, Tennessee Paducah Operations Office, Paducah, Kentucky (Plant) Piketon Area Office Portsmouth Area Office (Plant)	OR

Agency	Bureau	Abbreviation
	Saint Charles Area Office Thomas Jefferson National Accelerator Facility University of Puerto Rico Weldon Springs Operations Office Y-12 Plant	
	Oakland Operations Office Lab of Structural Biology and Molecular Medicine Lawrence Berkley National Laboratory Lawrence Livermore National Laboratory Radiobiology and Environmental Health Laboratory Stanford Linear Accelerator Center	OAK
	Office of Scientific and Technical Information	OSTI
	Ohio Field Office Ashtabula Environmental Management Project Columbia Area Office/Columbus Environmental Management Project Fernald Environmental Management Project Miamisburg Environmental Management Project West Valley Project Office	OH
	Philadelphia Regional Support Office	PRSO
	Pittsburgh Naval Reactors Office Bettis Atomic Power Laboratory Idaho Branch Office	PNRO
	Pittsburgh Research Center Denver Federal Center, Denver, Colorado Spokane Research Center, Spokane, Washington	PRC
	Richland Operations Office Environmental Restoration Contractor Fast Flux Test Facility (FFTF), Standby Project Office Occupational Health Services Office of River Protection Pacific Northwest National Laboratory Project Hanford Management Contract Tank Farm Operations Tank Waste Privatization	RL
	Rocky Flats Field Office Deputy Manager Rocky Flats Environmental Technology Site	RFFO
	Savannah River Operations Office	SRO
	Schenectady Naval Reactors Office Knolls Atomic Power Laboratory	SNRO
	Seattle Regional Support Office	SRSO
	Southeastern Power Administration Office	SEPA
	Southwestern Power Administration Office Gore Area Office, Gore, Oklahoma Springfield Area Office, Springfield, Missouri	SWPA
	Strategic Petroleum Reserve Project Office	SPR
	Western Area Power Administration Corporate Services Office Desert Southwest Regional Office Rocky Mountain Regional Office Sierra Nevada Regional Office Upper Great Plains Regional Office	WAPA
	Yucca Mountain Site Characterization Office	YMSC
Equal Employment Opportunity Commission		EEOC
Environmental Protection Agency		EPA
	Office of the Administrator/Deputy Administrator	AO
	Office of Administration and Resource Management	OARM
	Office of Air and Radiation	OAR

Agency	Bureau	Abbreviation
	Office of Enforcement and Compliance Assurance	OECA
	Office of Environmental Information	OEI
	Office of the Chief Financial Officer	OCPO
	Office of General Counsel	OGC
	Office of Inspector General	OIG
	Office of International Activities	OIA
	Office of Prevention, Pesticides, and Toxic Substances	OPTS
	Office of Research and Development	ORD
	Office of Solid Waste and Emergency Response	OWER
	Office of Water	OW
Federal Aviation Administration		FAA
	Transportation System Center	TSC
	FAA Alaskan Region	AL
	FAA Central Region	CE
	FAA Eastern Region	EA
	FAA Great Lakes Region	GL
	FAA Headquarters	HQ
	FAA New England Region	NE
	FAA Northwest Mountain Region	NM
	FAA Southern Region	SO
	FAA Southwest Region	SW
	FAA Western Pacific Region	WP
Federal Communications Commission		
	Enforcement Bureau	EB
	Office of Engineering and Technology	OET
	Office of Managing Director	OMD
	Wireless Telecommunications Bureau	WTB
Federal Mediation and Conciliation Service		FMCS
Federal Deposit Insurance Corporation		FDIC
Federal Housing Finance Agency		FHFA
	Office of Inspector General	OIG
Federal Reserve System		FRS
Federal Trade Commission		FTC
General Accounting Office		GAO
Government Printing Office		GPO
General Services Administration		GSA
	General Property Resources Service	D
	Office of Federal Supply and Services	F
	Office of Inspector General	J
	Office of Information Resources Management	K
	Public Buildings Service	P
	Office of Federal Protection and Safety	PS
Health and Human Services, Department of		HHS
	Department Wide	OSDW
	Immediate Office of the Secretary	OSIO
	Office of the Inspector General	OSIG
	Office of Public Health & Science	OSEP
	Administration for Children & Families	ACF
	Centers for Disease Control & Prevention	CDC
	Centers for Medicare and Medicaid	CMS
	Food and Drug Administration	FDA
	Health Care Financing Administration	HCFA
	Health Resources and Services Administration	HRSA
	Indian Health Services	IHS
	National Institutes of Health	NIH

Agency	Bureau	Abbreviation
	Program Support Center	PSC
	Substance Abuse & Mental Health Administration	SAMH
Homeland Security, Department of		DHS
	Bureau of Citizenship and Immigration Services	CIS
	Bureau of Customs and Border Protection	CBP
	Bureau of Immigrations and Customs Enforcement	ICE
	Department Offices	DO
	Federal Emergency Management Agency	FEMA
	Federal Law Enforcement Training Center	FLTC
	Federal Protective Service	FPS
	Information Analysis and Infrastructure Protection Directorate	IAIP
	Integrated Wireless Network	IWN
	National Coordination Center	NCC
	Office of Emergency Communications	OEC
	Office of the Inspector General	OIG
	Office of the Secretary	O
	Science and Technology Directorate	ST
	Transportation Security Administration	TSA
	U.S. Secret Service	S
	White House Communications Agency	D
House of Representatives		HR
Housing and Urban Development, Department of		HUD
Interior, Department of the		I
	American Samoa, Government of	A
	Bureau of Ocean Energy Management	BOEM
	Bureau of Safety and Environmental Enforcement	BSEE
	Geological Survey	G
	Geological Survey - Administrative	GA
	Geological Survey - Biological Resources Division	GB
	Geological Survey - Geologic Division Seismic	GG
	Geological Survey - Geologic Division Earthquake	GGE
	Geological Survey - Geologic Division Volcano	GGV
	Geological Survey - National Mapping Division	GT
	Geological Survey - Water Resources Division	GW
	Geological Survey - Not elsewhere classified	GZ
	Bureau of Indian Affairs	I
	Bureau of Indian Affairs - Aberdeen Area	IA
	Bureau of Indian Affairs - Anadarko Area	IB
	Bureau of Indian Affairs - Billings Area	IC
	Bureau of Indian Affairs - Juneau Area	IE
	Bureau of Indian Affairs - Minneapolis Area	IF
	Bureau of Indian Affairs - Muskogee Area	IG
	Bureau of Indian Affairs - Phoenix Area	IH
	Bureau of Indian Affairs - Sacramento Area	IJ
	Bureau of Indian Affairs - Central Office (Washington, DC)	IK
	Bureau of Indian Affairs - Law Enforcement	IL
	Bureau of Indian Affairs - Albuquerque Area	IM
	Bureau of Indian Affairs - Navajo Area	IN
	Bureau of Indian Affairs - Portland Area	IP
	Bureau of Indian Affairs - Eastern Area	IS
	Bureau of Indian Affairs - Joint use area	IW
	Bureau of Indian Affairs - Not elsewhere classified	IZ
	Bureau of Land Management	L
	Bureau of Land Management - Washington Office	LWO
	Bureau of Land Management - Alaska	LAK
	Bureau of Land Management - Arizona	LAZ

Agency	Bureau	Abbreviation
	Bureau of Land Management - California	LCA
	Bureau of Land Management - Colorado	LCO
	Bureau of Land Management - Idaho	LID
	Bureau of Land Management - Montana	LMT
	Bureau of Land Management - Nevada	LNv
	Bureau of Land Management - New Mexico	LNm
	Bureau of Land Management - Oregon	LOR
	Bureau of Land Management - Utah	LUT
	Bureau of Land Management - Wyoming	LWY
	Bureau of Land Management - Eastern States	LESO
	Bureau of Land Management - Denver Federal Center	LDfC
	Bureau of Land Management - National Training Center (PHX)	LNtC
	Bureau of Land Management - National Fire Center (Boise)	LNfC
	Office of the Secretary	O
	Aircraft Management Division	OAS
	Office of Surface Mining	OSM
	National Park Service	P
	National Park Service - Alaska Region	PAK
	National Park Service - Intermountain Region	PIM
	National Park Service - Northeast Region	PNE
	National Park Service - Midwest Region	PMW
	National Park Service - National Capital Field Area	PNC
	National Park Service - Pacific West Region	PPW
	National Park Service - Southeast Region	PSE
	National Park Service – Unites States Park Police	PPP
	National Park Service - Not elsewhere classified	PZZ
	Bureau of Reclamation	R
	Bureau of Reclamation - Great Plains	RGP
	Bureau of Reclamation - Lower Colorado	RLC
	Bureau of Reclamation - Mid-Pacific	RMP
	Bureau of Reclamation - Pacific Northwest	RPN
	Bureau of Reclamation - Upper Colorado	RUC
	Bureau of Reclamation - Not elsewhere classified	RZZ
	U.S. Fish and Wildlife Service	S
	GUM, HI, ID, MDW, OR, PAC, WA	S1
	AZ, NM, OK, TX	S2
	IA, IL, IN, MI, MN, MO, OH, WI	S3
	AL, AR, FL, GA, KY, LA, MS,NC, SC, TN, PR, VI	S4
	CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT, VA, WV	S5
	CO, KS, MT, NE, ND, SD, UT, WY	S6
	AK	S7
	CA, NV	S8
	Not elsewhere classified	S9
	Trust Territory of the Pacific Islands, Government of the (including Government of the Northern Marianas)	T
International Trade Commission		ITC
Justice, Department of		J
	Alcohol, Tobacco, Firearms and Explosives	A
	Bureau of Prisons	BP
	Drug Enforcement Administration	D
	Federal Bureau of Investigation	FB
	Integrated Wireless Network	IWN
	Justice Management Division	JMD
	Justice-Wide (including Offices, Boards, and Divisions of the Department)	JW

<b>Agency</b>	<b>Bureau</b>	<b>Abbreviation</b>
	Justice Wireless Network	JWN
	U.S. Marshals Service	M
Labor, Department of		L
Library of Congress		LC
National Aeronautics and Space Administration		NASA
	Ames Research Center	ARC
	Armstrong Flight Research Center	DFRC
	Glenn Research Center	GRC
	Goddard Space Flight Center	GSFC
	NASA Headquarters	HQS
	Jet Propulsion Laboratory	JPL
	Johnson Space Center	JSC
	Kennedy Space Center	KSC
	Langley Research Center	LARC
	Marshall Space Flight Center	MSFC
	Stennis Space Center	SSC
	Wallops Flight Facility	WFF
	White Sands Test Facility	WSTF
National Archives and Records Administration		NARA
National Endowment for the Arts		NEA
National Gallery of Art		NGAL
National Geospatial-Intelligence Agency		NGA
National Labor Relations Board		NLRB
National Security Agency		NS
National Science Foundation		NSF
	Kitt Peak National Observatory	KPNO
	National Astronomy and Ionosphere Center	NAIC
	National Center for Atmospheric Research	NCAR
	National Radio Astronomy Observatory	NRAO
	Sacramento Peak Observatory	SPO
Navy, Department of the (U.S. Navy)		N
	United States Navy	USN
	United States Naval Research Laboratory	NRL
Navy, Department of the (U.S. Marine Corps)		MC
	United States Marine Corps	USMC
Nuclear Regulatory Commission		NRC
Office of Personnel Management		OPM
Pension Benefit Guaranty Corporation		PBGC
Railroad Retirement Board		RRB
Securities and Exchange Commission		SEC
Senate, U.S.		SEN
Small Business Administration		SBA
	Office of the Inspector General	G
Smithsonian Institution		SI
Social Security Administration		SSA
State, Department of		S
	Bureau of Economic and Business Affairs	EB
	Bureau of Information Resource Management	IRM
	Office of Foreign Missions	OFM
Supreme Court		SC
Tennessee Valley Authority		TVA

Transportation, Department of		TRAN
	Federal Highway Administration	H
	Federal Motor Carrier Safety Administration	FMC
	Federal Railroad Administration	R
	Federal Transit Administration	FTA
	Maritime Administration	MAR
	National Highway Traffic Safety Administration	T
	National Transportation Safety Board	NB
	Office of the Secretary	OS
	Pipeline and Hazardous Material Safety Administration	PHMS
	Transportation Technology Center	TTC
	Volpe Center	VOLP
	Great Lakes St. Lawrence Seaway Development Corporation	GLS
Treasury, Department of the		T
	Departmental Offices	DO
	Bureau of Engraving and Printing (BEP)	BEP
	Bureau of Fiscal Service	FS
	Treasury Inspector General for Tax Administration (TIGTA)	IGTA
	IRS Criminal Investigations Division (IRS-CID)	IRCI
	Internal Revenue Service (IRS) Facilities	IRF
	Integrated Wireless Network	IWN
	US Mint	M
	Office of the Inspector General	OIG
	Office of the Secretary	O
	Troubled Asset Relief Program	TARP
	Alcohol and Tobacco Tax and Trade Bureau	TTB
U.S. Agency for Global Media		USGM
U.S. Capitol Police		USCP
U.S. Chemical Safety Hazard Investigations Board		CSB
U.S. Court of International Trade		CIT
U.S. Peace Corps		USPC
U.S. Postal Service		USPS
	Postal Inspection Service	IS
	Mail Processing and Distribution	MAIL
	National Network Service Center	NET
	National Systems Development	NSD
	Office of the Inspector General	OIG
	Security	SEC
U.S. Trade and Development Agency		TDA
U.S. Trade Representative		USTR
Veterans Affairs, Department of		VA
	National Cemetery Administration	NCA
	Office of Inspector General	OIG
	VA Central Office	VACO
	Veterans Benefits Administration	VBA
	Veterans Health Administration	VHA



## G.1.1 Other Organizational Abbreviations

These abbreviations identify records which are recorded in the GMF for spectrum management and analysis purposes.

Organization	Abbreviation
CANADA	CAN
FEDERATED STATES OF MICRONESIA	FSM
MEXICO	MEX
NON-GOVERNMENT	NG
NON-GOVERNMENT RECORDS (70/80/90 GHz)	NGR
REPUBLIC OF PALAU	RP
REPUBLIC OF THE MARSHALL ISLANDS	RMI

## G.2 GEOGRAPHICAL ABBREVIATIONS

This section of Annex G contains those abbreviations that will be used in the Transmitter and Receiver State/Country fields (XSC/RSC) of the GMF. (See Section 9.8.2)

### G.2.1 U.S. (50 United States and the District of Columbia)

AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
CA	California
CO	Colorado
CT	Connecticut
DC	District of Columbia
DE	Delaware
FL	Florida
GA	Georgia
HI	Hawaii
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
LA	Louisiana
MA	Massachusetts
MD	Maryland

ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MS	Mississippi
MT	Montana
NC	North Carolina
ND	North Dakota
NE	Nebraska
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NV	Nevada
NY	New York
OH	Ohio
OK	Oklahoma
OR	Oregon
PA	Pennsylvania
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming

### G.2.2 U.S. Territories and Possessions

#### *Caribbean Area*

-	Navassa Island
PR	Commonwealth of Puerto Rico (including Culebra, Mona, and Vieques)
-	Quita Sueno Bank
-	Roncador Bank (Roncador Cay)
-	Serrana Bank (North Cay, Southwest Cay, Northwest Rocks, Dry Ledge)
-	Serranilla Bank (West Breaker, Beacon Cay)
VI	Virgin Islands (St. Croix, St. John, St. Thomas)

#### *Pacific Area*

-	Baker Island
GUM	Guam
HWL	Howland Island
JAR	Jarvis Island
JON	Johnston Island (including Sand Island)
-	Kingman Reef

MDW	Midway (Includes Eastern and Sand Islands)
MRA	(except Guam) Commonwealth of Northern Mariana Islands (Formerly Ladrone Islands) (Agrihan, Aguijan, Alamagan, Anatahan, Asuncion, Guguan, Maug, Medinilla, Pagan, Farallon de Pajaros, Rota, Saipan, Sarigan, and Tinian)
PLM	Palmyra Island (Some 50 islands make up the Atoll of Palmyra)
SMA	American Samoa (Aunuu, Manua Group [or Islands, i.e., Ofu, Olosega, Tau], Rose Island, Swains Island, Tutuila)
WAK	Wake Island

### G.2.3 Area and Other Abbreviations

AFR	Africa
ANTR	Antarctica
ARCO	Arctic Ocean
ASIA	Continent of Asia
CAM	Central America
CBN	Caribbean
EUR	Europe
FE	Far East (Countries of China, Japan, Korea, Thailand, Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Vietnam and East India)
GLM	Gulf of Mexico
GTLK	Great Lakes (collectively)
INDO	Indian Ocean
LAM	Latin America
LANT	Atlantic Ocean
LERI	Lake Erie
LHUR	Lake Huron
LMIC	Lake Michigan
LONT	Lake Ontario
LSUP	Lake Superior
MED	Mediterranean Sea
MDE	Middle East
OCNA	Oceania
PAC	Pacific Ocean
RCVR	Restricted for use only in Passive Sensor and Radio Astronomy listings
SEA	Southeast Asia
SPCE	Space
US	For US only when transmitting and/or receiving in all 50 United States and the District of Columbia
USA	For use only when transmitting and/or receiving in the 48 Contiguous States of the United States and the District of Columbia (This Excludes Alaska and Hawaii)
USP	For use only when transmitting and/or receiving throughout the US (50 states and

District of Columbia), the Commonwealth of Puerto Rico, and the Territories and Possessions (does not include the former Trust Territory of the Pacific Islands)

XXXX See Section 9.8.2, paragraph 21.b

### G.2.4 Country Abbreviations

ABW	Aruba
AFG	Afghanistan (Islamic State of)
AFS	South Africa (Republic of)
AGL	Angola (Republic of)
AIA	Anguilla
ALB	Albania (Republic of)
ALG	Algeria (People's Democratic Republic of)
ALS	Alaska (not for use in GMF; for ITU use only)
AMS	Saint Paul and Amsterdam Islands
AND	Andorra (Principality of)
AOE	Western Sahara
ARG	Argentine Republic
ARM	Armenia (Republic of)
ARS	Saudi Arabia (Kingdom of)
ASC	Ascension
ATA	Antarctic
ATG	Antigua and Barbuda
ATN	Netherlands Antilles
AUS	Australia
AUT	Austria
AZE	Azerbaijani Republic
AZR	Azores
B	Brazil (Federative Republic of)
BAH	Bahamas (Commonwealth of the)
BDI	Burundi (Republic of)
BEL	Belgium
BEN	Benin (Republic of)
BER	Bermuda
BFA	Burkina Faso
BGD	Bangladesh (People's Republic of)
BGR	Bulgaria
BHR	Bahrain (State of)
BIH	Bosnia & Herzegovina (Republic of)
BIO	British Indian Ocean Territory
BLR	Belarus (Republic of)
BLZ	Belize
BOL	Bolivia (Republic of)
BOT	Botswana (Republic of)
BRB	Barbados
BRU	Brunei Darussalam
BTN	Bhutan (Kingdom of)
CAF	Central African Republic
CAN	Canada
CAR	Caroline Islands

CBG	Cambodia (Kingdom of)	GCA	Territories of the United Kingdom in Region 1
CHL	Chile (except Easter Island)	GCC	Territories of the United Kingdom in Region 3
CHN	China (People's Republic of)	GDL	Guadeloupe (French Department of)
CHR	Christmas Island (Indian Ocean)	GEO	Georgia (Republic of)
CKH	Cook Islands	GHA	Ghana
CLM	Colombia (Republic of)	GIB	Gibraltar
CLN	Sri Lanka (Democratic Socialist Republic of)	GMB	Gambia (Republic of the)
CME	Cameroon (Republic of)	GNB	Guinea-Bissau (Republic of)
CNR	Canary Islands	GNE	Equatorial Guinea (Republic of)
COD	Democratic Republic of the Congo	GRC	Greece
COG	Congo (Republic of the)	GRD	Grenada
COM	Comoros (Islamic Federal Republic of the)	GRL	Greenland
CPV	Cape Verde (Republic of)	GTM	Guatemala (Republic of)
CRO	Crozet Archipelago	GUF	Guiana (French Department of)
CTI	Cote d'Ivoire (Republic of)	GUI	Guinea (Republic of)
CTR	Costa Rica	GUM	Guam
CUB	Cuba	GUY	Guyana
CVA	Vatican City State		
CYM	Cayman Islands		
CYP	Cyprus (Republic of)		
CZE	Czech Republic		
D	Germany (Federal Republic of)	HKG	Hong Kong
DGA	Diego Garcia	HND	Honduras (Republic of)
DJI	Djibouti (Republic of)	HNG	Hungary (Republic of)
DMA	Dominica (Commonwealth of)	HRV	Croatia (Republic of)
DNK	Denmark	HTI	Haiti (Republic of)
DOM	Dominican Republic	HWA	Hawaii (not for use in GMF; for ITU use only)
E	Spain	I	Italy
EGY	Egypt (Arab Republic of)	ICO	Cocos Keeling Islands
EQA	Ecuador	IND	India (Republic of)
ERI	Eritrea	INS	Indonesia (Republic of)
EST	Estonia (Republic of)	IRL	Ireland
ETH	Ethiopia	IRN	Iran (Islamic Republic of)
		IRQ	Iraq (Republic of)
		ISL	Iceland
		ISR	Israel (State of)
F	France	J	Japan (includes Iwo Jima, Marcus Island, Ryu Kyu Islands)
FJI	Fiji (Republic of)	JMC	Jamaica
FLK	Falkland Islands (Malvinas)	JON	Johnston Island
FIN	Finland	JOR	Jordan (Hashemite Kingdom of)
FRO	Faroe Islands		
FSM	Micronesia (Federated States of) (Kapingamarangi, Kosrae, Lamotrek, Namonuito, Nukuoro, Oroluk, Pohnpei, Truk, Ulithi, Woleai, Yap)	KAZ	Kazakhstan (Republic of)
		KEN	Kenya (Republic of)
		KER	Kerguelen Islands
G	United Kingdom of Great Britain and Northern Ireland	KGZ	Kyrgyz Republic
GAB	Gabonese Republic	KIR	Kiribati (Republic of)
		KNA	Saint Kitts and Nevis (Federation of)
KRE	Democratic People's Republic of Korea	KOR	Korea (Republic of)
KWT	Kuwait (State of)	LBN	Lebanon
		LBR	Liberia (Republic of)
LAO	Lao People's Democratic Republic	LBY	Libya (Socialist People's Libyan Arab Jamahiriya)

LCA	Saint Lucia	PAQ	Easter Island (Chile)
LIE	Liechtenstein (Principality of)	PHL	Philippines (Republic of the)
LSO	Lesotho (Kingdom of)	PHX	Phoenix Islands
LTU	Lithuania (Republic of)	PLM	Palmyra Island (some 50 islands make up the Atoll of Palmyra)
LUX	Luxembourg	PLW	Palau (Republic of)
LVA	Latvia (Republic of)	PNG	Papua New Guinea
MAC	Macao	PNR	Panama (Republic of)
MAU	Mauritius (Republic of)	POL	Poland (Republic of)
MCO	Monaco (Principality of)	POR	Portugal
MDA	Moldova (Republic of)	PRG	Paraguay (Republic of)
MDG	Madagascar (Democratic Republic of)	PRU	Peru
MDR	Madeira	PTC	Pitcairn Island
MDW	Midway Islands	PTR	Puerto Rico (including Culebra, Mona, and Vieques) (not for use in GMF; for ITU use only)
MEX	Mexico		
MHL	Marshall Islands (Republic of the) (Ailinglapalap, Arno, Ebeye, Enewetak, Jaluit, Kwajalein, Majuro, Mili, Roi-Namur, Rongelap)	QAT	Qatar (State of)
MKD	Macedonia (Republic of) (The Former Yugoslav Republic of Macedonia)	REU	Reunion (French Department of)
MLA	Malaysia	ROD	Rodriguez
MLD	Maldives (Republic of)	ROU	Romania
MLI	Mali (Republic of)	RUS	Russian Federation
MLT	Malta	RRW	Rwandese Republic
MMR	Myanmar	S	Sweden
MNE	Montenegro	SCN	Saint Christopher and Nevis
MNG	Mongolian People's Republic	SDN	Sudan (Republic of the)
MOZ	Mozambique (Republic of)	SEN	Senegal (Republic of)
MRA	Mariana Islands (except Guam)	SEY	Seychelles (Republic of)
MRC	Morocco (Kingdom of)	SHN	Saint Helena
MRN	Marion Island	SLM	Solomon Islands
MRT	Martinique (French Department of)	SLV	El Salvador (Republic of)
MSR	Montserrat	SMA	American Samoa
MTN	Mauritania (Islamic Republic of)	SMO	Western Samoa (Independent State of)
MWI	Malawi	SMR	San Marino (Republic of)
MYT	Mayotte Island	SNG	Singapore (Republic of)
NCG	Nicaragua	SOM	Somali Democratic Republic
NCL	New Caledonia	SPM	Saint Pierre and Miquelon (French Department of)
NFK	Norfolk Island	SRB	Serbia
NGR	Niger (Republic of the)	STP	Sao Tome and Principe (Democratic Republic of)
NIG	Nigeria (Federal Republic of)	SUI	Switzerland (Confederation of)
NIU	Niue Island	SUR	Suriname (Republic of)
NLD	Netherlands (Kingdom of)	SVK	Slovak Republic
NMB	Namibia (Republic of)	SVN	Slovenia (Republic of)
NOR	Norway	SWN	Swan Islands
NPL	Nepal	SWZ	Swaziland (Kingdom of)
NRU	Nauru (Republic of)	SYR	Syrian Arab Republic
NZL	New Zealand		
OCE	French Polynesia	TCA	Turks and Caicos Islands
OMA	Oman (Sultanate of)	TCD	Chad (Republic of)
PAK	Pakistan (Islamic Republic of)	TGO	Togolese Republic
		THA	Thailand

TKL	Tokelau Islands
TJK	Tajikistan (Republic of)
TKM	Turkmenistan
TLS	Timor-Leste (Democratic Republic of)
TON	Tonga (Kingdom of)
TRC	Tristan da Cunha
TRD	Trinidad and Tobago
TUN	Tunisia
TUR	Turkey
TUV	Tuvalu
TZA	Tanzania (United Republic of)
UAE	United Arab Emirates
UGA	Uganda (Republic of)
UKR	Ukraine
URG	Uruguay (Eastern Republic of)
USA	The 48 contiguous States of the United States of America and the District of Columbia (excludes the States of Alaska and Hawaii)
UZB	Uzbekistan (Republic of)
VCT	St. Vincent and the Grenadines
VEN	Venezuela (Republic of)
VIR	United States Virgin Islands (St. Croix, St. John, St. Thomas) (not for use in GMF; for ITU use only)
VRG	British Virgin Islands
VTN	Vietnam (Socialist Republic of)
VUT	Vanuatu (Republic of)
WAK	Wake Island
WAL	Wallis and Futuna Islands
YEM	Yemen (Republic of)
ZMB	Zambia (Republic of)
ZWE	Zimbabwe (Republic of)

### **G.3 AREAS, DIVISIONS, AND DISTRICTS WITHIN THE CONTERMINOUS UNITED STATES**

This section of Annex G contains descriptions and/or maps of certain areas, divisions and districts within the Conterminous U.S., which appear in the GMF. (The FEMA & U.S. Coast Guard maps are an exception as they show overseas areas.)

#### **G.3.1 Corps of Engineers Divisions and Districts (no description-see Figure 1)**

#### **G.3.2 Tennessee Valley Authority Area (see Figure 2)**

The area bounded on the west by the Mississippi River, on the north by the parallel of latitude 37°30'N, and on the east and south by that arc of the circle with center at Springfield, Illinois, and radius equal to the airline distance between Springfield, Illinois, and Montgomery, Alabama, subtended between the foregoing west and north boundaries.

#### **G.3.3 U.S. Coast Guard Areas and Districts (see Figure 3)**

Atlantic Area 1st, 5th, 7th, 8th and 9th Districts.

Pacific Area 11th, 13<sup>th</sup>, 14<sup>th</sup> and 17th Districts.

1st District Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York except that part north of 42°N and West of 74°39'W; that part of New Jersey north of 39°57'N, east of 74°27'W and northeast of a line from 39°57'N West to the New York, New Jersey and Pennsylvania boundaries at Tristate.

5th District Delaware, Maryland, Virginia, District of Columbia, North Carolina, that portion of New Jersey south of 39°57'N, west of 74°27'W and south of a line extending northwesterly from 39°57'N, 74°27'W to the New York, New Jersey and Pennsylvania boundaries at Tristate.

7th District South Carolina; and Florida and Georgia, except that part of Florida and Georgia west of a line from the intersection of the Florida coast with longitude 83°50'W due north to a position 30°15'N 83°50'W, thence due west to a position 30°15'N 84°45'W, thence due north to the intersection with the south shore of Jim Woodruff Reservoir, thence along the east bank of the Jim Woodruff Reservoir and the east of the Flint River up stream to Montezuma, Georgia, thence to West Point, Georgia; the Panama Canal Zone; Puerto Rico including Culebra, Mona, and Vieques, Quita Sueno Bank, Roncador Bank (Roncador Cay), Serrana Bank (North Cay, Southwest Cay, Northwest Rocks, Dry Ledge, (, Serranilla Bank (West Breaker, Beacon Cay) and the Virgin Islands (St. Croix, St. John, St. Thomas), District 7 includes the islands of Navassa Island; the U.S. Naval Reservations in the islands of the West Indies and on the north coast of South America; and the ocean areas that are encompassed by a line bearing 122 degrees True from coastal end of the Fifth and Seventh Coast Guard District land boundary of the National Maritime Search and Rescue Region; thence along the eastern and the offshore boundary between the Seventh and Eighth Coast Guard Districts that is defined as a line that extends 199 degrees True from the coastal end of the Seventh and Eighth Coast Guard District land boundary; thence along this line to the coast.

8th District Wyoming, Colorado, New Mexico, Texas, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, Missouri, Iowa, West Virginia, Kentucky, Tennessee, and; Pennsylvania south of latitude 41° N and west of longitude 79° W; those parts of Ohio and Indiana south of latitude 41°N; Illinois, except that part north of latitude 41°N and east of longitude 90°W; Wisconsin south of latitude 46°20' N and west of longitude 90° W; Minnesota south of latitude 46°20'N and that part of Florida and Georgia west of a line from the intersection of the Florida coast with longitude 83°50'W due north to a position 30°15'N 83°50'W; thence due west to a position 30°15'N 84°45'W; thence due north to the intersection with the south shore of Jim Woodruff Reservoir; thence along the east bank of the Jim Woodruff Reservoir and the east bank of the Flint River up stream to Montezuma, Georgia; thence to West Point, Georgia.

9th District Michigan; New York north of latitude 42°N and west of longitude 74°39'W; Pennsylvania north of latitude 41°N and west of longitude 79°W; those parts of Ohio and Indiana north of latitude 41°N; Illinois north of latitude 41°N and east of longitude 90°W; Wisconsin except that part south of latitude 46°20'N and west of longitude 90°W; and Minnesota north of latitude 46°20'N.

11th District California, Nevada, Arizona, and Utah.

13th District Washington, Oregon, Idaho, and Montana.

14th District The Fourteenth Coast Guard District, with District office in Honolulu, Hawaii, is comprised of: the State of Hawaii, the Pacific island possessions of the U.S. south of latitude 40 degrees North and west of a line that runs from 40 degrees North, 150 degrees West through latitude 5 degrees South, 110 degrees West; the ocean area west and south of a line that runs from position 51 degrees North, 158 degrees East to position 43 degrees North, 165 degrees East; thence due south to latitude 40 degrees North; thence due east to longitude 150 degrees West; then southeasterly through latitude 5 degrees South, longitude 110 degrees West. Guam, Howland Island, Jarvis Island, Johnston Island (including Sand Island) Kingman Reef, Midway (Includes Eastern and Sand Islands), Commonwealth of Northern Mariana Islands (Formerly Ladrone Islands) (Agrihan, Aguijan, Alamagan, Anatahan, Asuncion, Guguan, Maug, Medinilla, Pagan, Farallon de Pajaros, Rota, Saipan, Sarigan, Tinian and excluding Guam. Palmyra Island (Some 50 islands make up the Atoll of Palmyra), American Samoa (Aunuu, Manua Group [or Islands, i.e., Ofu, Olosega, Tau], Rose Island, Swains Island, Tutuila), Wake Island.

17th District Alaska.

### **G.3.4 U.S. Navy-Marine Corps MARS Regions (see Figure 4)**

Region One -- Connecticut, Delaware, Massachusetts, Maine, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont.

Region Two -- Alabama, District of Columbia, Florida, Georgia, Kentucky, Maryland, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, West Virginia.

Region Three -- Arkansas, Louisiana, New Mexico, Oklahoma, Texas.

Region Four -- Colorado, Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, North Dakota, Nebraska, South Dakota, Wisconsin, Wyoming.

Region Five -- Arizona, California, Nevada, Utah.

Region Seven -- Alaska, Idaho, Montana, Oregon, Washington.

Region Eight -- Hawaii, Pacific Area U.S. Territories.

### **G.3.5 U.S. Army Areas (see Figure 5)**

ARA1 - (States of Alabama, Connecticut, Delaware, Florida, Georgia, Kentucky, Maine, Maryland (less certain area which are included in the Military District of Washington), Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia (less certain areas which are included in the Military District of Washington), and West Virginia).

ARA5 - (Arkansas, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Missouri, Nebraska, Ohio, Oklahoma, Texas (less Fort Bliss), and Wisconsin).

ARA6 - (California, Colorado (less the area west of 108 deg. West), Idaho, Oregon, Montana, Nevada, North Dakota, South Dakota, Utah (less the area east of 111 degrees West), Washington, Wyoming).

### **G.3.6 U.S. Army Frequency Coordination Areas (see Figure 6)**

AFMO US&P - Alabama, Alaska, Arkansas, California, Colorado (less the area west of 108° West), Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland (less certain areas which are included in the Military District of Washington), Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas (less Fort Bliss and US Territory within 240 kilometers radius of White Sands Missile Range), Utah (less the area east of 111° West), Vermont, Virginia (less certain areas which are included in the Military District of Washington), Washington, West Virginia, Wisconsin, and Wyoming; Puerto Rico and the Virgin Islands.

Military District of Washington (Headquarters: Washington, DC)-District of Columbia, counties of Arlington, Fairfax (less Fort Belvoir, but including Davison AAF), and City of Alexandria in the state of Virginia, and counties of Montgomery and Prince Georges in the state of Maryland.

State of Arizona, Fort Huachuca, Arizona-Arizona.

White Sands Missile Range, New Mexico-New Mexico, U.S. territory within a 240 kilometer radius of WSMR (includes Fort Bliss, Texas), plus the area of Utah and Colorado that lies between 108° and 111° W.

### **G.3.7 FAA Regions (no Figure)**

### **G.3.8 The Coordination of Unclassified Frequencies Will be Done Through the FAA Webfer Web Portal Located at [Https://Webfer.Faa.Gov](https://Webfer.Faa.Gov) (See Annex D).NRC Regions (see Figure 7)**

Region I-Headquarters at King of Prussia, PA, Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

Region II-Headquarters at Atlanta, GA, Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia.

Region III-Headquarters at Glen Ellyn, IL,  
Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin.

Region IV-Headquarters at Arlington, TX, Arkansas, Colorado, Idaho, Kansas, Louisiana, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, Wyoming.

Region V-Headquarters at Walnut Creek, CA, Arizona, California, Nevada, Oregon, Washington.

### **G.3.9 FEMA Regions (see Figure 8)**

Region I-Headquarters at Boston, MA, and underground Federal Response Center (FRC) at Maynard, MA; includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Region II-Headquarters at New York, N.Y.; includes New Jersey, New York, Puerto Rico, and the Virgin Islands.

Region III-Headquarters at Philadelphia, PA; includes Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia.

Region IV-Headquarters at Atlanta, GA, and underground Federal Response Center (FRC) at Thomasville, GA; includes Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

Region V-Headquarters at Chicago, IL; includes Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Region VI-Headquarters and underground Federal Response Center (FRC) at Denton, TX; includes Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Region VII-Headquarters at Kansas City, MO; includes Iowa, Kansas, Missouri, and Nebraska.

Region VIII-Headquarters and underground Federal Response Center (FRC) at Denver, CO; includes Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

Region IX-Headquarters at San Francisco, CA; includes Arizona, California, Hawaii, Nevada, American Samoa, Guam, Commonwealth of the Northern Mariana Islands, and the Federated States of Micronesia.

Region X-Headquarters and underground Federal Response Center (FRC) at Bothell, WA; includes Alaska, Idaho, Oregon, and Washington.

### **G.3.10 EPA Regions (see Figure 9)**

Region I-Headquarters at Boston, MA, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.

Region II-Headquarters at New York, N.Y. New Jersey, New York, Puerto Rico, Virgin Islands.

Region III-Headquarters at Philadelphia, PA, Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia.

Region IV-Headquarters at Atlanta, GA, Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee.

Region V-Headquarters at Chicago, IL, Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin.

Region VI-Headquarters at Dallas, TX, Arkansas, Louisiana, New Mexico, Oklahoma, Texas.

Region VII-Headquarters at Kansas City, KS, Iowa, Kansas, Missouri, Nebraska.

Region VIII-Headquarters at Denver, CO, Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming.

Region IX-Headquarters at San Francisco, CA, Arizona, California, Nevada, Hawaii, Guam, American Samoa.

Region X-Headquarters at Seattle, WA, Idaho, Oregon, Washington, Alaska.

### **G.3.11 GSA Regions (see Figure 10)**

Region I-Headquarters at Boston, MA includes: Connecticut, Maine, Massachusetts, New Hampshire, Rhode



Island, and Vermont.

Region II-Headquarters at New York, NY includes: New Jersey, New York, Puerto Rico, and Virgin Islands.

Region III-Headquarters at Philadelphia, PA includes: Delaware, Maryland, Pennsylvania, Virginia, and West Virginia.

Region IV-Headquarters at Atlanta, GA includes: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

Region V-Headquarters at Chicago, IL includes: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Region VI-Headquarters at Kansas City, MO includes: Iowa, Kansas, Missouri, and Nebraska.

Region VII-Headquarters at Fort Worth, TX includes: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Region VIII-Headquarters at Denver, CO includes: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

Region IX-Headquarters at San Francisco, CA includes: American Samoa, Arizona, California, Guam, Hawaii, and Nevada.

Region X-Headquarters at Auburn, WA includes: Alaska, Idaho, Oregon, and Washington. National Capital Region Headquarters in Washington, DC includes: the District of Columbia, Montgomery and Prince Georges counties in Maryland, Arlington, Alexandria, Fairfax, Loudon, and Prince William in Virginia.

### G.3.12 USAF MARS Regions (see Figure 11)

Area	Regions
Northeast	I, II, III
Southeast	IV
North Central	V, VII
South Central	VI
Northeast	VIII, X
Southwest	IX

Region	States
I or 1	CT, MA, ME, NH, RI, VT
II or 2	NJ, NY
III or 3	DE, MD (including DC) PA, VA, WV
IV or 4	AL, FL (including PR, VI), GA, KY, MS, NC, TN, SC
V or 5	IL, IN, MI, MN, OH, WI
VI or 6	AR, LA, NM, OK, TX
VII or 7	IA, KS, MO, NE
VIII or 8	CO, MT, ND, SD, WY, UT
IX or 9	AZ, CA, NV, HI, GUM and Pacific Islands
X or 10	AK, ID, OR, WA

### **G.3.13 VA National Cemetery System Memorial Service Networks (MSN) by State**

MSN 1-Maine, Vermont, New Hampshire, Connecticut, Rhode Island, Massachusetts, Pennsylvania, New Jersey, New York, Maryland, Delaware, Northern 4/5th of Virginia, West Virginia.

MSN 2-Arkansas, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, Louisiana, Florida, Puerto Rico, Southern 1/5th of Virginia along the North Carolina border.

MSN 3-North Dakota, Montana, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, New Mexico, Texas.

MSN 4-Michigan, Minnesota, Wisconsin, Iowa, Illinois, Indiana, Missouri, Ohio, Kentucky.

MSN 5-Washington, Oregon, Idaho, Nevada, Utah, California, Arizona, Alaska, Hawaii.

### **G.3.14 VA Health Administration Integrated Service Network by (VISN) by Boundaries (see Figure 13)**

VISN 1 Maine, Vermont, New Hampshire, Connecticut, Rhode Island, Massachusetts.

VISN 2 Upper New York State.

VISN 3 Lower New York State. New York City.

VISN 4 Pennsylvania.

VISN 5 Delaware, Maryland.

VISN 6 Virginia, North Carolina.

VISN 7 South Carolina, Georgia, Alabama.

VISN 8 Florida.

VISN 9 Tennessee, Kentucky, West Virginia.

VISN 10 Ohio.

VISN 11 Northern Indiana, Michigan.

VISN 12 Northern Illinois, Wisconsin.

VISN 15 Southern Indiana, Southern Illinois, Missouri, Kansas.

VISN 16 Mississippi, Louisiana, Arkansas, East Texas, Oklahoma.

VISN 17 Central Texas.

VISN 18 West Texas, New Mexico, Arizona

VISN 19 Colorado, Utah, Wyoming, Montana.

VISN 20 Idaho, Washington, Oregon

VISN 21 Northern Nevada, Northern California.

VISN 22 Southern Nevada, Southern California.

VISN 23 Nebraska, Iowa, North Dakota, South Dakota, Minnesota.

**Figure 1: Corps of Engineers**

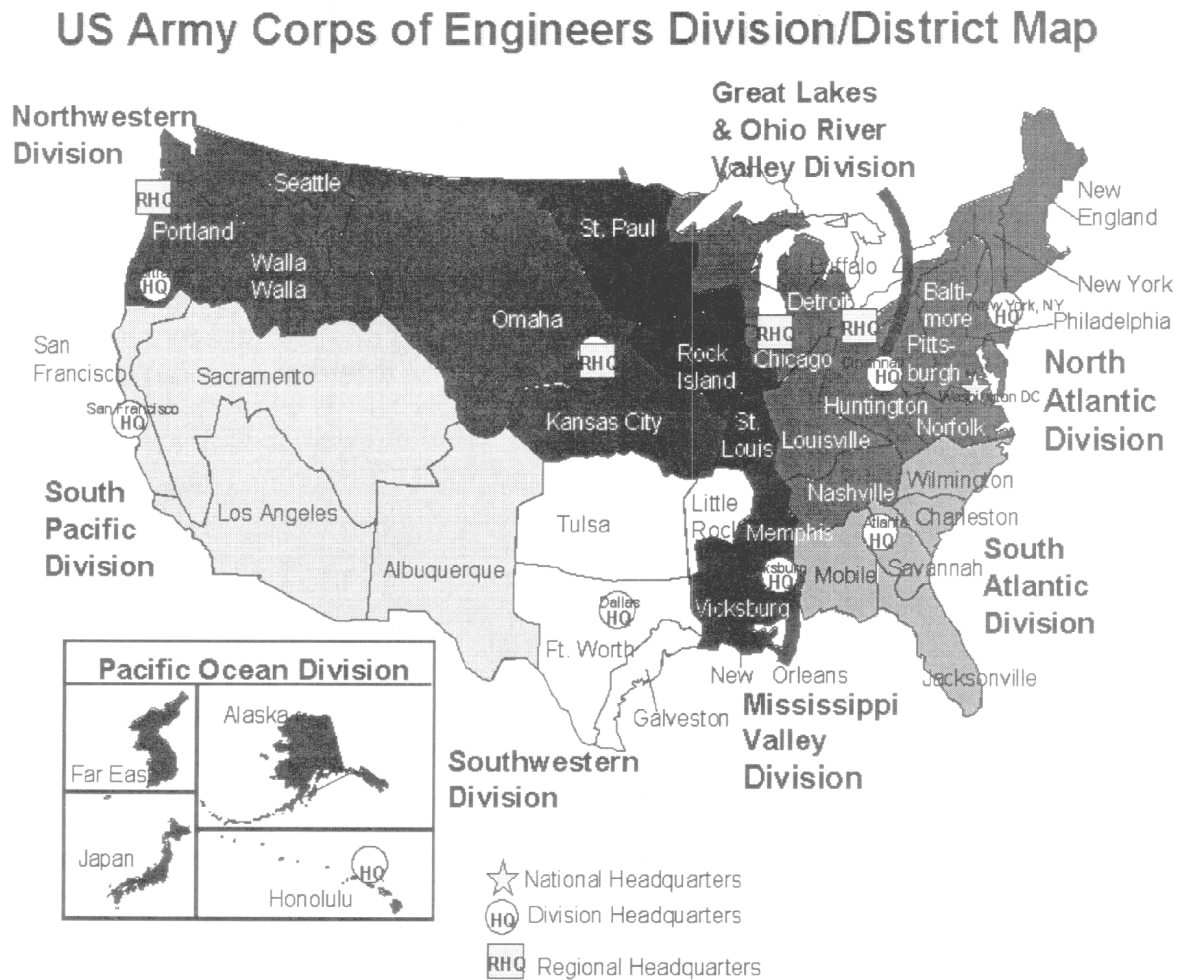


Figure 2: Tennessee Valley Authority

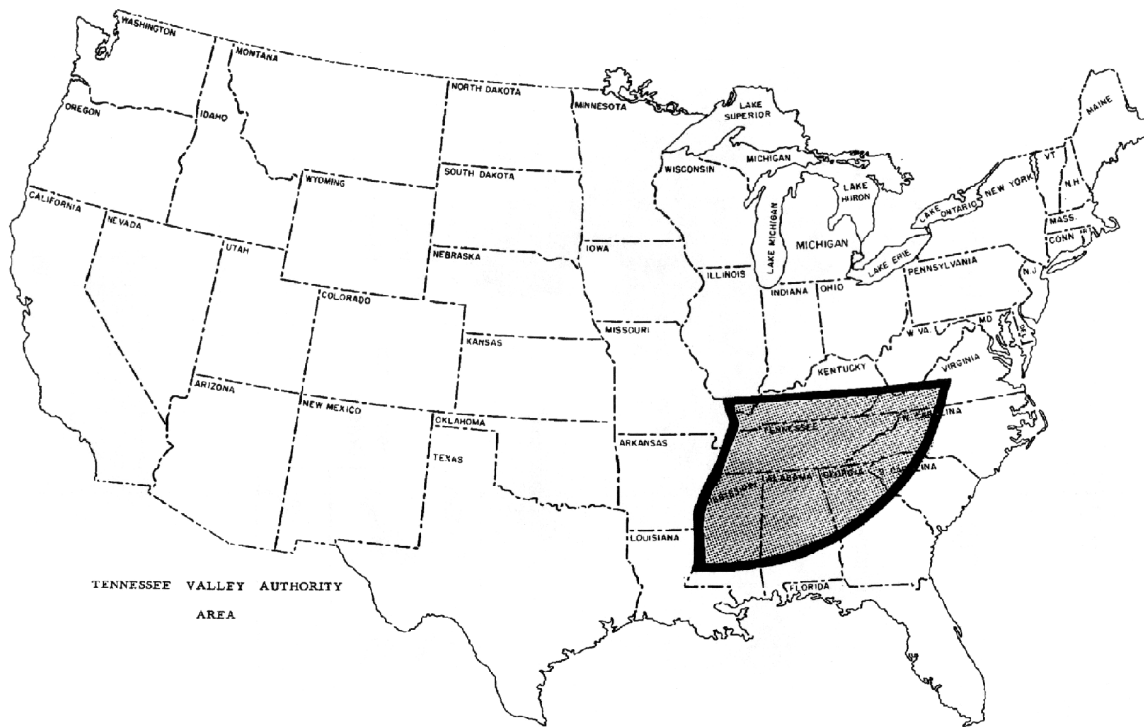


Figure 3: U.S. Coast Guard Districts

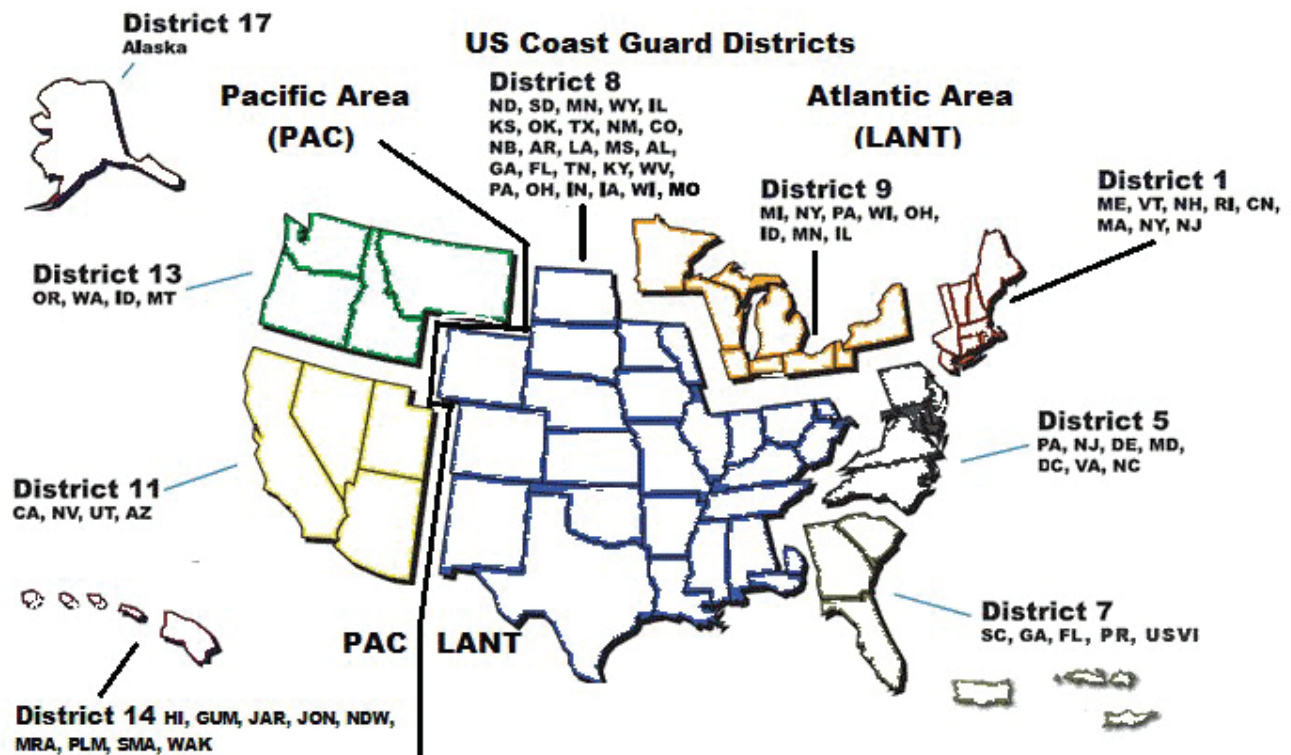
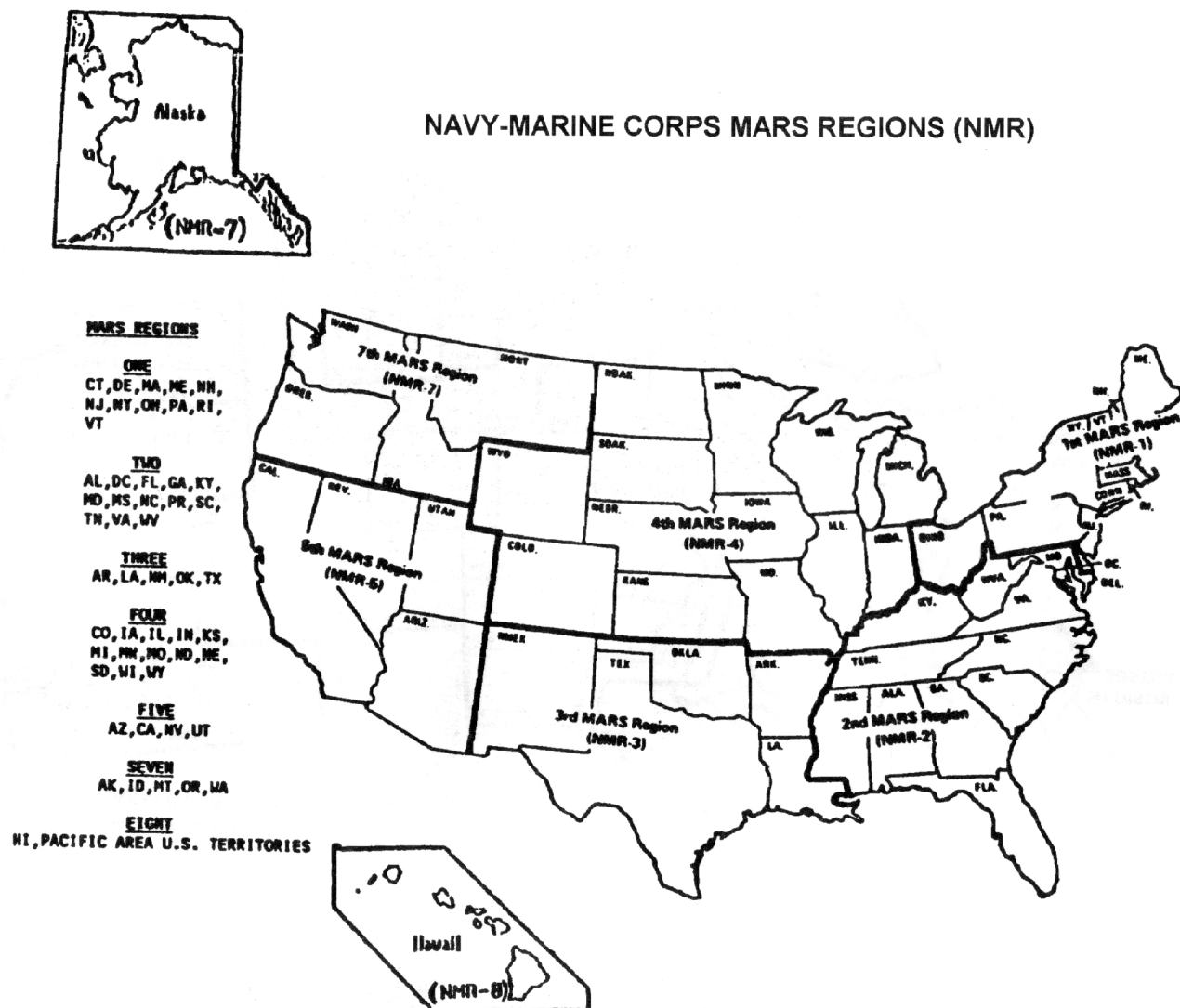


Figure 4: U.S. Navy-Marine Corps MARS Regions



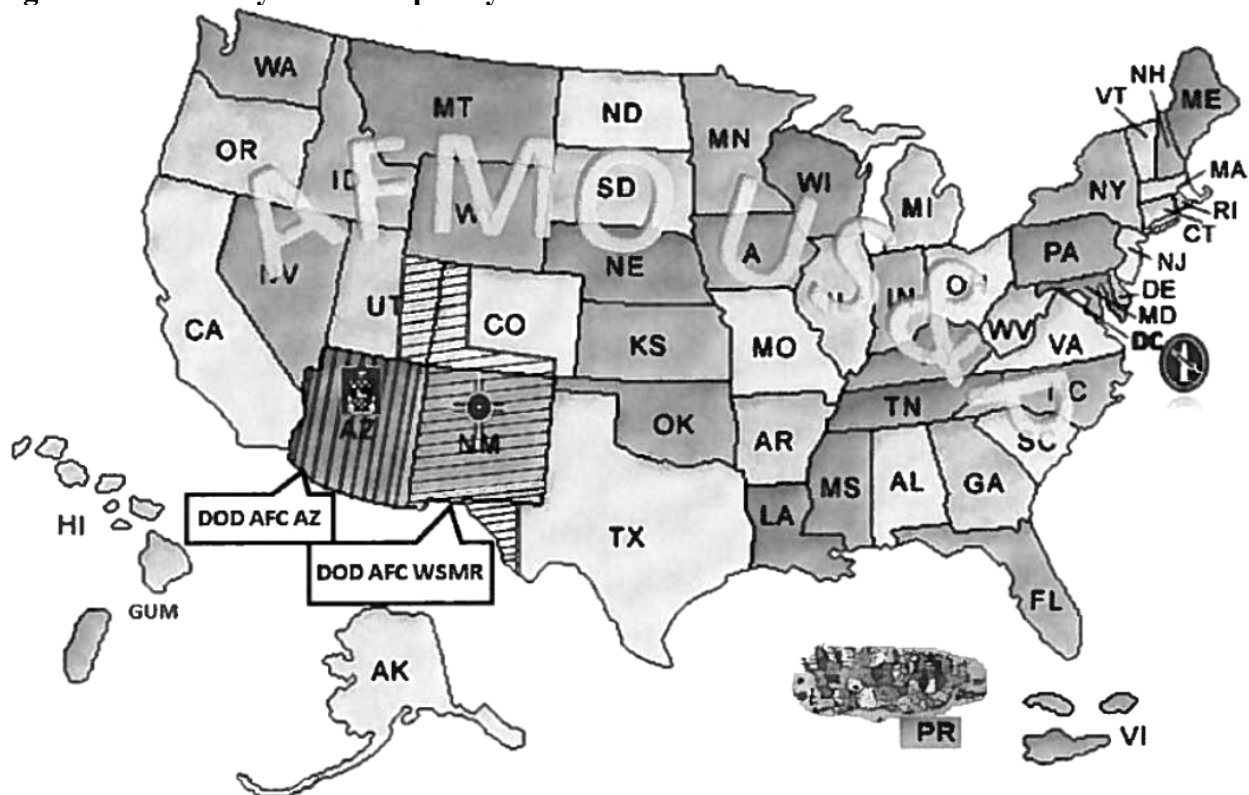
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*G.3.14*

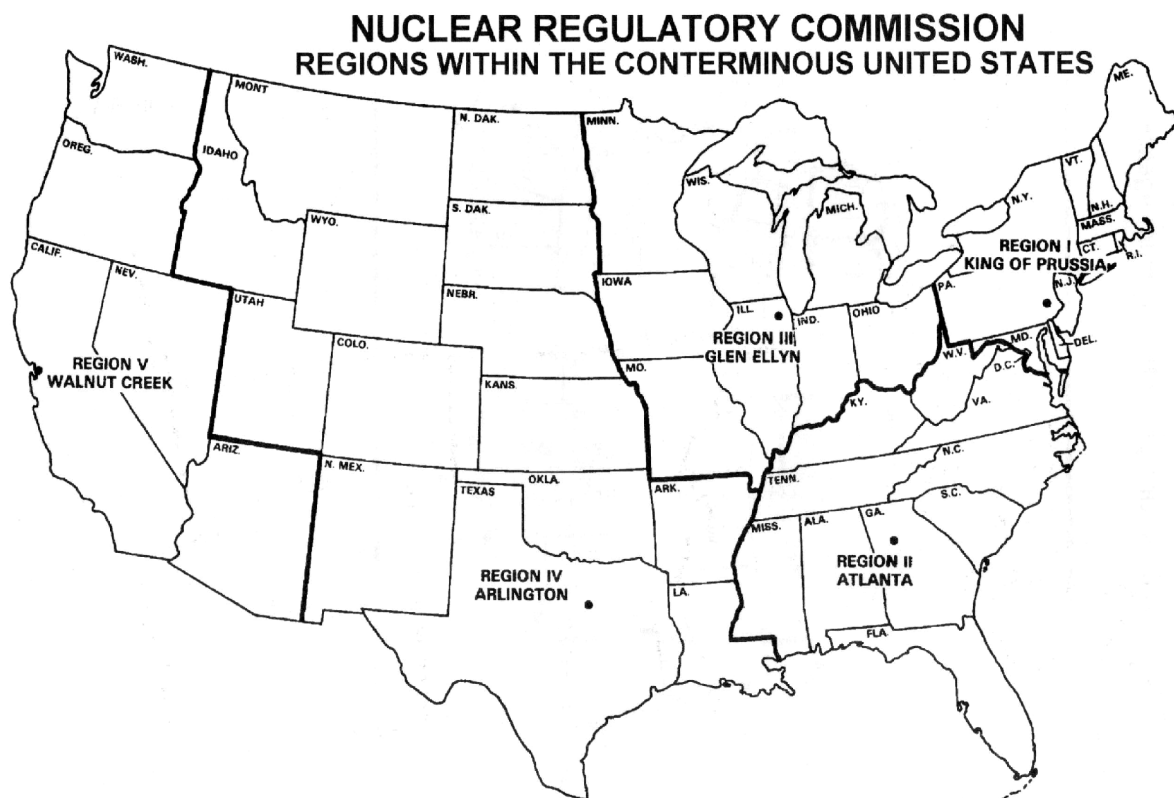


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*January 2021 Edition (Rev. 1/2023)*



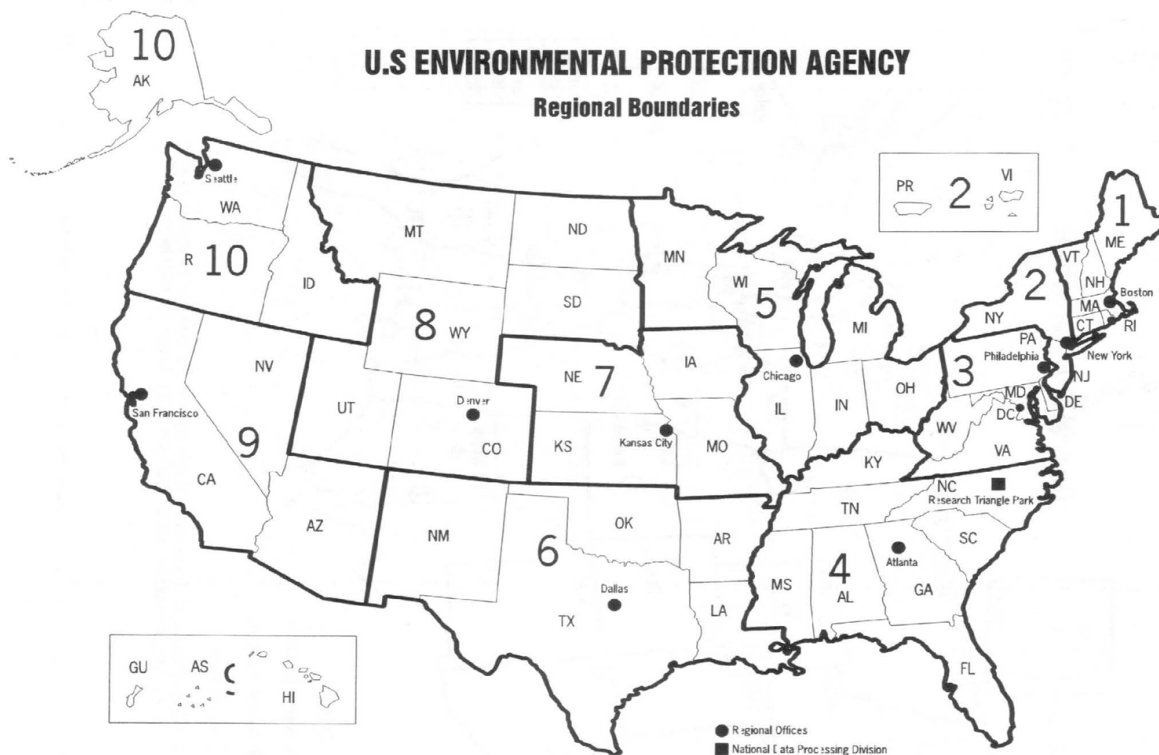
**Figure 7: Nuclear Regulatory Commission Regions**



**Figure 8: Federal Emergency Management Agency Regions**

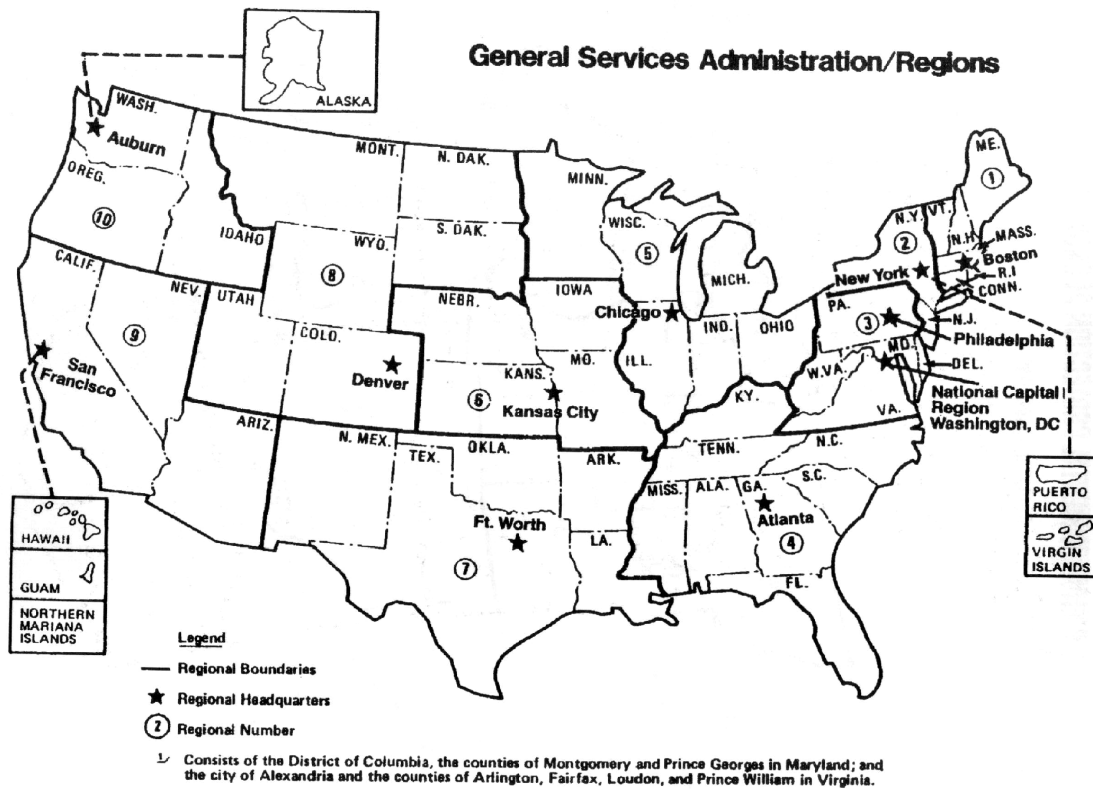


**Figure 9: U.S. Environmental Protection Agency Regions**

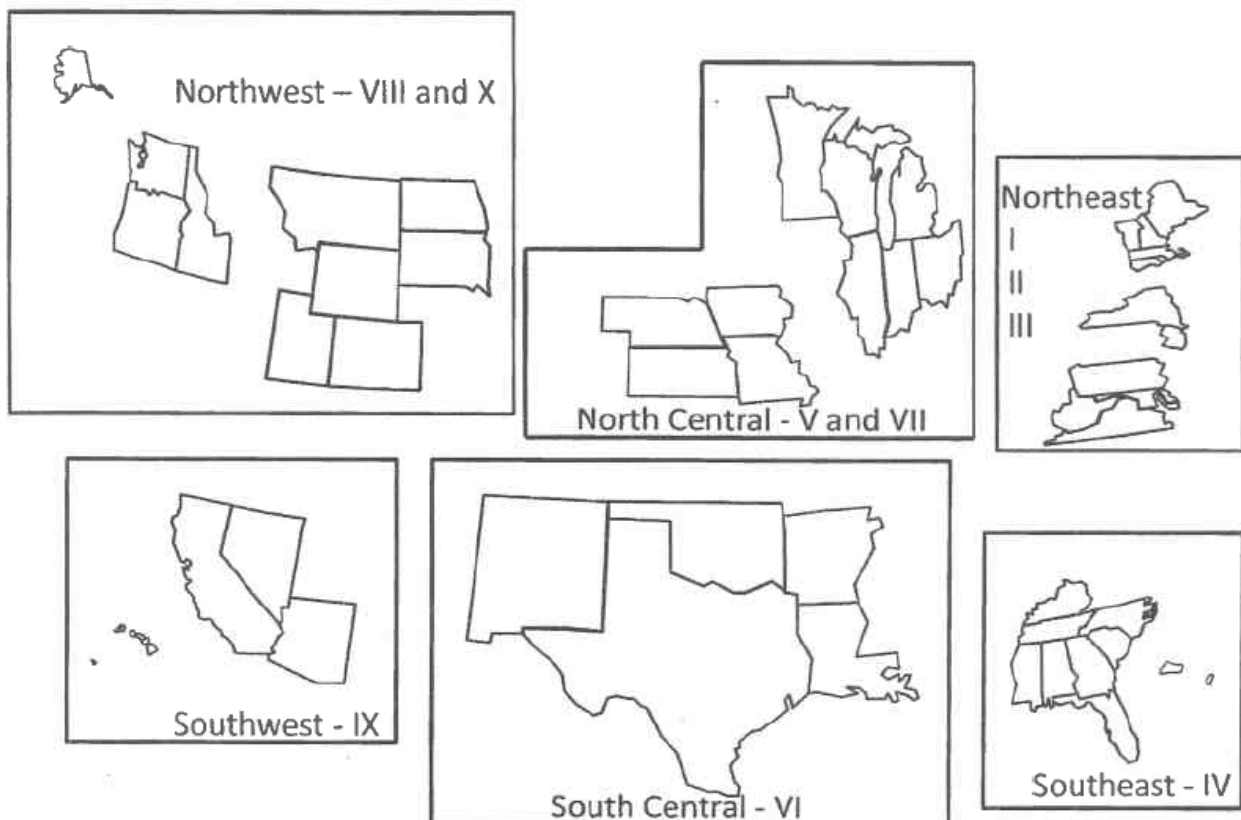




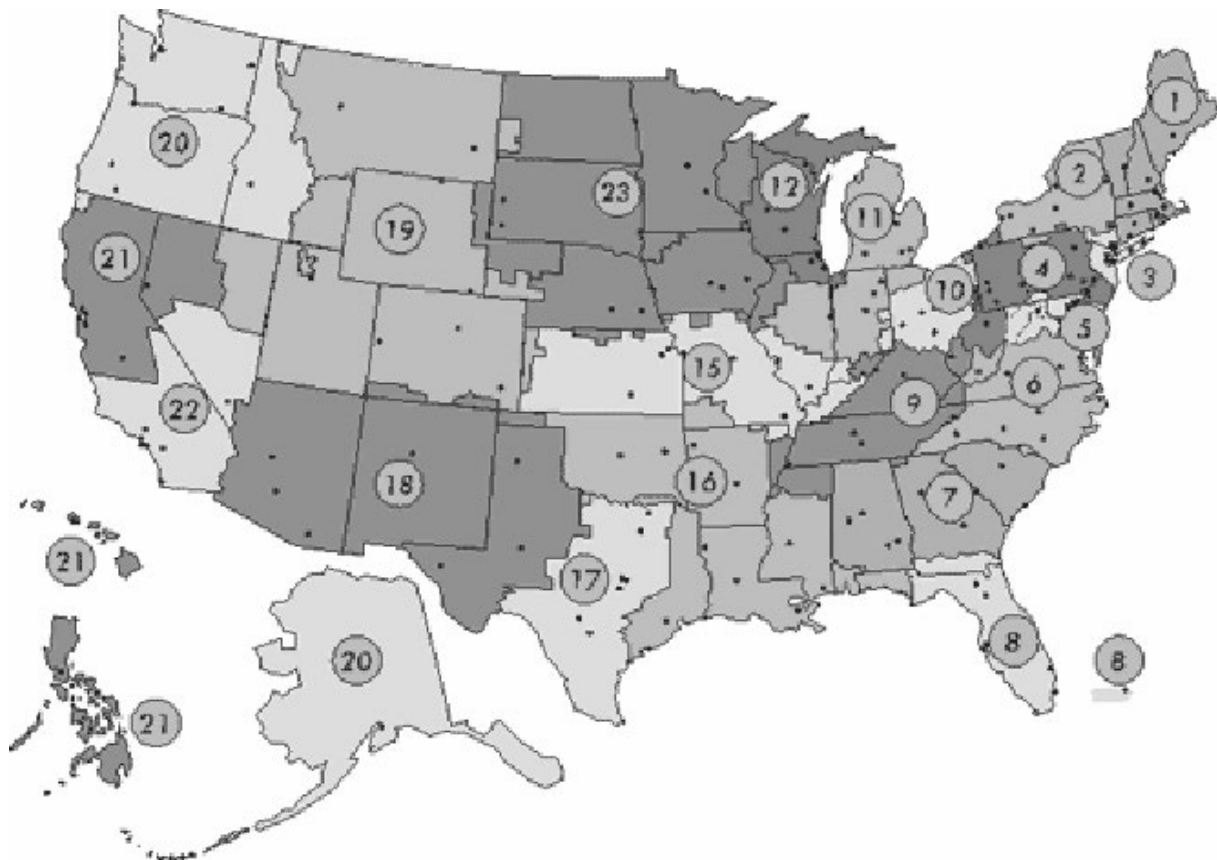
**Figure 10: General Services Administration Regions**



**Figure 11: U.S. Air Force Mars Regions**



**Figure 12: Veterans Affairs Health Administration Integrated Service Network by (VISN) by Boundaries**



#### G.4 COMMON ABBREVIATIONS

AAF	ARMY AIR FIELD	IS	ISLANDS
ARA	ARMY AREA	JB	JOINT BASE
ARPT	AIRPORT	LNB	LARGE NAVIGATIONAL BUOY
CGD	COAST GUARD DISTRICT	MAP	MUNICIPAL AIRPORT
CO	COUNTY	MT	MONT, MONTE, MOUNT(S)
CP	CAMP	MTN	MOUNTAIN(S)
CY	CITY	PG	PROVING GROUND(S)
DI	DISTRICT	POE	POINT OF ENTRY
DIV	DIVISION	PT	POINT
FT	FORT	ST	SAINT
IAP	INTERNATIONAL AIRPORT		

#### G.5 MANUFACTURER CODES

This section of Annex G contains those manufacturer codes that will be used in the Circuit Remarks (REM) fields of the GMF (see Section 9.8.2, 39.o, General).

A		AAT	Airsys ATM
AAC	AACOMM, Inc.	ABN	Aruba Networks
AAI	Aircraft Armaments Inc.	ACC	ACE Communications
AAO	Aero Astro LLC	ACE	Aeronautical Communications Equipment Inc.
AAS	AES Corporation	ACI	Air Communications Inc.

ACO	Aerospace Corporation	ASC	Astronomics Corp.
ACP	Accipiter	ASE	Astral Electronics Inc.
ACR	Acrodyne or Acrodyne Industries Inc.	ASG	Allied Signal Commercial Aviation System
ACT	ALCATEL	ASI	Alto Scientific Inc.
ADN	Advanced Navigation Inc.	ASL	Aareff Systems Limited
ADS	General Electric/Astro Space Division	ASM	Astromarine Products Corp.
ADU	Advanced Communications Systems Inc.	ASP	A/S S.P. Radio
ADV	Audio-Vac	ASR	Astra LLC
AEC	Allied Electronics Corp.	AST	Astro Communication Laboratories or Astaron Electronics Ltd.
AEO	Aer-O-Com	ASY	Antenna Systems Inc.
AER	Aeronautical Electronic Inc.	ATC	Astro Telecom Corp.
AES	Aerosonic Corp.	ATE	Advanced Tech Talk
AGI	Agilent	ATF	Advanced Techcom Inc.
AGN	AGA Navigation Aids Limited	ATI	Amerasia Technology Inc.
AGT	Amegint Technologies	ATM	Automation Inc.
AHI	Aleth Inc.	ATN	Aviat Networks
AIC	Atmospheric Instrumentation Research Corp.	ATT	American Telephone & Telegraph
AID	Audio Intelligence Devices Inc.	ATX	Advanced Training Systems
AIE	Aire-Sciences, Inc.	AUD	Audio-Sine, Inc.
AII	Atmospheric Instrument Research, Inc.	AUT	Audio-Technica US Inc.
AIL	Airborne Instrument Laboratories	AVC	Advantech Corp.
AIM	Artemis Inc.	AVE	Aveillant
AIO	AIRONET	AVI	Avitron Inc.
AIR	Aireon Manufacture Corp.	AVN	Aerovironment
AIS	Air Science Inc.	AVR	Alvarion
AKL	Akela Corporation	AVT	Avtek Co.
ALC	Applied Research Corp.	AWC	Athena Wireless Communications
ALL	Allison Electronics	AWI	All Weather Inc.
ALN	Alenia Spazio	AYD	Aydin
ALO	ALINCO	AYI	Airport Systems International, Inc.
ALP	Aleph Inc.	AZD	Azden, Inc.
ALT	Altech Lansing	<b>B</b>	
ALV	Alva Radio Industries	BAC	Barry Research Corp.
ALX	Aeroflex Lintek Corporation	BAD	BAE Systems
AMH	Amherst Systems, Inc.	BAE	Barth Engineering & Mfg. Co.
AMP	Advanced Microwave Products	BAN	Belair Networks
AMK	Ameri-King Corporation	BAO	Baofeng Ltd.
AMR	Amplifier Research Corporation	BAR	Barrett Electronics
AMS	American Systems	BBC	Black Box Corporation
AND	Andrew Corp.	BDW	BridgeWave Communications
ANO	ANACOM	BEA	Becker Avionics
ANP	Antenna Products Co.	BEE	Beel Technologies, Inc.
ANR	Anritsu	BEG	Bendix/King Mobile Communications
ANS	Antenna Specialists Co.	BEN	Bendix Corp. or Bendix Aviation Corp.
ANT	Arnet	BER	Bertea Products or Bertea Corporation
AOC	Air Associates Co.	BEX	Bext Inc.
API	Applied Research, Inc.	BLS	Balise
APN	Applied Concepts	BMI	Battelle Memorial Institute
APO	Appareo Systems	BMS	Broadcast Microwave Services
APS	Applied Systems Engineering	BOA	Boeing Aerospace
APT	Applied Technology	BOE	Boeing Aircraft
ARA	ARTAIS Inc.	BRG	BRG Precision Products
ARB	Airbus	BRI	Bristol Aerospace Ltd.
ARC	Aircraft Radio Corp.	BRK	Briartek Incorporated
ARE	Atlantic Research Corp.	BRN	Baron Services
ARJ	Aeronautical Radio Inc. or ARINC	BRT	Broadcast Electronics
ARM	Armstrong Transmitting Corp.	BTI	Burle Technologies, Inc.
ART	Allied Radio Shack	BUT	Butler National Corp.
ARX	Artex Aircraft Supplies, Inc.	BVS	Berkeley Varitronics Systems
ARY	Airsys ATM Inc.		

BZR Bonzer, Inc.  
 BSC Braxton Services Company  
**C**  
 CAB Campbell Manufacture Company, Ltd.  
 CAC Cessna Aircraft Co.  
 CAI Communications Associates, Inc.  
 CAM Cambium Networks  
 CAP Communications Applied Technology  
 CAR Canadian Radio Corp.  
 CAT Canadian Telephone Co.  
 CAV Cavotec Microcontrols  
 CAW CalAmp Wireless Network Corporation  
 CBE Crown Broadcast Electronics  
 CBM CBM Electronics  
 CBS Campell Scientific, Inc.  
 CCB Control Chiefs, Inc.  
 CCC Cadion Communications Corp.  
 CCD Control Industries  
 CCF Coastal Climate Company  
 CCI Communications Carriers, Inc.  
 CCJ Communications Co., Inc.  
 CCP Continental Electric Corporation  
 CDD Combat Direction Systems Activity Dam Neck  
 CDN Cardian Electronics  
 CDP Codan Pty, Ltd.  
 CDS Cubic Defense Systems  
 CEC Continental Electronics Corporation  
 CEG Ceragon Networks Inc.  
 CEL Colorado Electronics  
 CEM Continental Electronics Manufacturing Co.  
 CEO Celesco Industries  
 CER Centry Research Corp.  
 CET CETEC Vega  
 CFM California Microwave  
 CHM Chesapeake Microwave  
 CIC Cubic Industrial Corp.  
 CIN Cincinnati Electronic Corp.  
 CIS Cisco  
 CKI CACI International, Inc.  
 CLN Ciello Networks  
 CLO Ciello Digital Radios  
 CLU Campbell Scientific Inc. Of Logan Utah  
 CMI CMI, Inc.  
 CMO Canadian Motorola  
 CMS Commscope  
 CMT COMMTACT, Inc.  
 CMU Communitronics Ltd  
 CNC Conic Corp.  
 CNI Contraves Italiana  
 COA Communication Specialities  
 COB Cobra  
 COC Communication Co.  
 COI Comtech Lab, Inc.  
 COL Collins Radio Co.  
 COM Comrex  
 CON Continental Electronics, Ltd.  
 COP Communications Products Co.  
 COS Cosser Electronic  
 COU Courier Communications, Inc.  
 CPI CPI, Communications

CRB Commercial Resources Communications  
 CRP Concord Electronics Corp.  
 CRT Cartwright Electronics Inc.  
 CRU Cruise Technology  
 CSC Customs Signal Corp.  
 CSD Cobham  
 CSI Control Science, Inc.  
 CSP CSpeed  
 CTE CEA Technologies  
 CTL Crescend Technologies LLC  
 CTM Continental Microwave & Tool Co.  
 CTR Cattron, Inc.  
 CTW Commtech Wireless  
 CUB Cubic Co.  
 CUS Cush Craft  
 CWE Comwave  
 CWI Cartwright, Inc.  
 CYB Cybermation  
**D**  
 DAE Davco Electronics Inc.  
 DAN Daniels Electronics Limited  
 DAT Data Control Systems  
 DBM Three DBM Systems  
 DCE Decatur Electronics, Inc.  
 DCI Defense Communications Engineering Inc.  
 DCM Delcom  
 DCT De Tect, Inc.  
 DDL Doodle Labs  
 DEA Decca Radar Ltd. UK  
 DEC dbSpectra Systems  
 DEL Del Mar Avionics  
 DES Delstar Corp.  
 DET Detroit Bullet Trap Co.  
 DIG Digital Radio  
 DII Digi International Inc.  
 DIT Digitize, Inc.  
 DIX Dixon Industries Corp.  
 DLN Del Norte  
 DMC Digital Microwave Corp.  
 DMI Data Marine International  
 DMS Detection Monitoring Technologies  
 DNT Del Norte Technology, Inc.  
 DOR Dorsett Laboratories  
 DOS Dorsett Electronics Division (LaBarge, Inc.)  
 DRA Drake RF Co.  
 DRI Decca Radar, Inc.  
 DRK Data Radio Corp.  
 DRS DRS Technologies  
 DSI Delta Sigma Inc.  
 DSY Defense Systems, Inc.  
 DTA D-TA Systems Inc.  
 DTC DTC Communications  
 DTE Daytong Electronics, Ltd.  
 DTM Datum  
 DTW Datawell  
 DUO Duotech  
 DWI DragonWave Inc.  
 DXR DX Radio Corp.  
 DYC Dynamic Communications  
 DYN Dynetics, Inc.

DYS Dynascan Corp.  
**E**  
EAD European Aeronautic Defense and Space Co.  
EAI Elta-Ashdod Israel  
EAR Earmark, Inc.  
ECL Eaton Corp. AIL DIVN.  
ECH Echodyne Corp.  
ECR Edcor  
EDO EDO Corp.  
EDR EDO Aire  
EEE EMCEE, Co.  
EFD EF Data  
EGX Energy-Onix  
EIP Electromatic, Inc.  
ELA Ellason  
ELM Electronic Material International, Ltd.  
ELS Electromagnetic Sciences, Inc.  
EMA Electro Magnetic Sciences Co.  
EMC Electronics Missiles Communications, Inc.  
EMH Electro-Mechanics Co.  
EMI EMI-Cossor Electronics Ltd. or EMI Marine Division  
EMR Electro Mechanical Research, Inc.  
ENI Electronic Navigation Instruments  
ENT Enerdyne Technologies Inc.  
EPS EPSCO, Inc.  
ERA Ericsson, L.M. Ltd.  
ERD Emhiser Rand  
ERI Electronics Research Industries  
ERN Erichson  
ERX Emhiser Research, Inc.  
ESC Esco  
ESD ESL, Inc.  
ESE Electronic System Technology  
ESI Energy Systems, Inc.  
EST Electric Service Co.  
ETC Eagle Telecom  
ETE Enterprise Electronics, Inc.  
ETR Ecatek, Inc.  
ETS Electronic Systems Technology  
EWR EWR Weather Radar Systems  
EXA Exalt Communications Inc.  
EXI EXICOM New Zealand, Ltd.  
EXT Executone, Inc.  
**F**  
FAA Federal Aviation Administration  
FAL Frant, Alan I.W.  
FAP Fran Air Products Co.  
FAR Farnsworth TV Radio  
FAS Ford Aerospace Corp.  
FEC Farinon Electric  
FER Ferguson Communications, Inc.  
FFS Free Flight Systems  
FGI Fleetwood Group, Inc.  
FLL Flight Refuel, Ltd.  
FLR FLIR Systems Inc.  
FLT Flite-Tronics  
FMI Farinon Microwave  
FMN Fluid Mesh Networks  
FMU Fmuser

FOR Fort Worth Tower Co.  
FOT Fortress Technologies  
FRC First RF Corp.  
FRF FRF Communications  
FRW Freewave Inc.  
FSG Futurecom Systems Group Inc.  
FUJ Fujitsu Tem Corp. of America  
FUR Furuno  
FUT Futaba  
**G**  
GAA General Atomics Aeronautical Systems  
GAE General Aviation Electronics  
GAI Garmin International  
GAL Granger Associates, Ltd.  
GAT Gates Radio Co.  
GCS Globecom Systems Inc.  
GDE General Dynamics/Electronics  
GDI Godfrey Engineering, Inc.  
GDP GDP Space Systems  
GEC GEC Telecommunications, Ltd.  
GEL General Electronics Laboratories, Inc.  
GEM Gem Marine Products  
GEN General Electric Corp.  
GEP Genesys Systems  
GEV Genave  
GIC General Instrument Corp.  
GIT Georgia Institute of Technology  
GLB GLB Electronics, Buffalo, N.Y.  
GLM Global Microwave Systems  
GLS Globalstar LLC.  
GMC General Motors Corp.  
GME General Microwave Services  
GMI General Microwave Corporation  
GMS Galaxy Micro Systems, Inc.  
GMW Global Microwave, Inc.  
GNI GPS Networking Inc  
GON Gonset Corp. or Gonset Division of Aerotron or Dumont Division of Gonset  
GOT Gotenna  
GPS GPS Source Inc.  
GRA Granger Associates or Bauer Broadcast Division of Granger  
GRC General Radio Co.  
GRO Ground Data Corp.  
GRT General Radiotelephone Co.  
GRY Gryphon, Inc.  
GSI Geophysical Survey Systems, Inc.  
GYE Glenayre  
**H**  
HAC Harris Corp.  
HAD Harris Aerospace Systems Div.  
HAN Handar Company  
HAR Harvey Radio Laboratories, Inc.  
HDS Household Data Services, Inc.  
HEL Hermes Electronics  
HEP Hewlett Packard  
HFI Harris Farinon, Inc.  
HFR Haigh-Farr, Inc.  
HIC Harris Intertype Corp.  
HII Herley Industries



HIS	Highway Information Systems, Inc.	JHU	Johns Hopkins University
HIT	Hitec RCD Inc.	JMA	JMA Wireless
HME	Hartman Marine Electronics Corp.	JOH	Johnson E.F.
HMI	HM Electronics, Inc.	JOT	Jotron USA, Inc.
HMS	Herley Microwave Systems	JRC	Japan Radio Co.
HNS	Hughes Network Systems	JTC	Janteq Corp.
HON	Honeywell	<b>K</b>	
HOR	Horizon	KAR	Kaar Engineering
HOU	Houston Radar	KDK	KDK Inc.
HRC	Henry Radio Co.	KED	Kenwood
HRS	Hendy Radio Service	KEL	Kelvin Hughes, Ltd.
HSA	Hallands Signal Attaraten	KEN	Kennedy Co.
HSC	Hawkeye Systems Corp.	KFE	K-F Electronics
HSI	Hi Sierra	KIG	Kingfisher
HTI	Hamtronics, Inc.	KIN	King Radio Corp.
HTS	HT Systems	KLT	Leltron Corp.
HUA	Huawei Technologies Co. Ltd.	KOD	Koden America, Inc
HUG	Hughes Aircraft Co.	KON	Kongsberg Seatex AS
HUL	Hull Electronics Co.	KRA	Kraft Systems
HYD	Hydrolinx	KRS	Kratos
HYE	Hy-Gain Electronics Corp.	KST	Keysight Technologies, Inc.
HYP	Hyperlink Technologies	KTA	Keltron Corporation
HYT	Hytera America	KTI	Keltec Industries
<b>I</b>		KTS	Koos Technical Services
IBI	IBIS Tek	KUS	Kustom Signal Corp.
IBM	International Business Machine Co.	KUX	Kustom Electronics Inc.
ICM	ICOM	<b>L</b>	
ICO	International Corp.	LAB	La Barge, Inc.
ICS	Industrial Comm Systems	LAC	Loea Corporation
ICX	ICX Technologies	LAN	Lance Antenna Corp.
IEC	IEC Electronics Corp.	LAR	Largo Electronic Manufacturers Inc.
IFR	Instrument Flight Research Corp.	LCA	Univ. of Lowell Center for Atmospheric Research
ILS	International Laser Systems, Inc.	LCT	Locata Corp.
IMC	International Microwave Corp.	LCW	L3 Harris
IMR	Imsar LLC	LDS	Loral Data Systems
IMS	International Meteorological Systems	LEA	Lear, Inc.
IMT	Integrated Microwave Technologies	LED	Lucas Ledex
INC	INTRAC	LEN	Lenkurt Electric Co.
INE	Intech, Inc.	LEO	Leonardo
INN	Innoflight, Inc.	LET	Lectrosomics, Inc.
INT	Interstate Electronics Co.	LII	Litton Industries
IPA	IP Access	LIG	Ligowave
IRC	Islip Radio Corp.	LIL	Lincoln Laboratory
IRD	Iridium	LLL	Lawrence Livermore Laboratory
IPW	IP Wireless	LMB	Lambda RF Systems
ISC	International Signal Control	LNR	LNR Communications, Inc.
ISS	Information Station Specialist	LOA	Los Alamos National Laboratories
ITF	ITT Defense Communications	LOC	Lockheed Electronics
ITG	ITT Gilfillan	LOE	Loral Electronics Corp.
ITM	ITT Mackay Marine	LOM	Lockheed Martin Astro Space
ITO	ITT Aerospace/Optical	LOR	Lorain County Radio Corp.
ITP	International Telephone & Telegraph Corp. or ITT Industrial Products	LOS	Lockheed Sanders, Inc.
ITS	ITT Standard	LPB	Low Power Broadcast Co.
ITT	ITT Federal Laboratories	LPO	Linear Photonics
<b>J</b>		LRD	Laird Technologies
JDE	John Deere	LSC	L-3 Space Communications
JDT	Johnson Data Telemetry Corp.	LSI	Liteye Systems, Inc.
JEP	Jet Propulsion Laboratory	LTC	L-3 Communications
JER	Jerrold Electronics Corp.	LUC	Lucos Air Space
		LUM	Lumistar

LUX	Luxul Corporation	MOO	Moog Inc
LYN	Lynch Communications Systems, Inc.	MOT	Motorola Corp.
<b>M</b>		MOX	Mobile Communications
MAB	M/A Comm AC, Inc.	MPH	MPH Industries, Inc.
MAC	Marconi Instruments, Division of English Electronics	MPI	Microwave Products, Inc
MAE	Marine-Air Systems, Ltd.	MPN	Multipoint Network
MAG	Magnavox Co.	MRC	Midwest Radio Corp.
MAI	Moseley Associates, Inc.	MRE	Monicor Electronics
MAM	M/A COMM MAC	MRF	Mid-Atlantic RF Systems
MAR	Mark Products Co.	MRK	MikroTik
MAS	Mid American Relay Systems	MRR	Marti
MAT	Matrix Research Inc.	MRS	Micro Systems, Inc.
MAX	Maxson Electronics Corp. (Electronics Design)	MRT	Marti Electronics
MAZ	Mas Zengrande LTD	MSD	Marconi Space and Defense Systems
MBE	Marcel Bassaulet Electronics	MSY	Meteric Systems Corp.
MBR	Malibu Research	MTI	Mobile Telesystem, Inc.
MCA	Microair Avianics Pty Ltd	MTK	Metek GMBH
MCC	Microcom Corp.	MTN	Monitron Corp.
MCE	Micro Electronics	MTR	Meteor, Communications Corp.
MCI	Marconi Radio	MTS	Mobile Telesystems
MCJ	Marconi Electronics	MUT	Multitone Electronics, Ltd.
MCL	Microwave Cavity Laboratory	MVI	M/A-COM Video Systems, Inc.
MCN	Morris Communications Co	MWB	Microwave Bypass Systems
MCO	Micro Communications Co.	MWI	Microwave Innovations
MCS	Mercury Systems	MWO	Microwave Radio Corp.
MCT	Micro Control Specialities	MWS	Microwave Sensors
MDC	Microdyne Corp.	MWT	Marconi Wireless Telegraph Co., Ltd.
MDH	Madah-Com	MXN	Maxon Electronics, Inc.
MDM	Microwave Design Manufacturing, Inc.	<b>N</b>	
MDS	Metrodata Systems	NAS	Navico
MDY	Microwave Data System	NAU	Nautel
MET	Metrotek Electronics Co.	NAV	Naval Avionics
MTX	Morfax, Ltd.	NCC	Nutex Communications Corp
MGD	Meggitt Defense Systems	NEA	NEC America, Inc.
MGI	Megapulse, Inc.	NEC	Nemsclarke
MGT	Magnetek	NER	Nera
MHR	Minneapolis Honeywell Regulator	NEU	Neulink, Divn of Celltronics
MHS	Microhard Systems Inc.	NMT	New Mexico Tech
MIB	Mitsubishi Denki Co. or Mitsubishi Electric	NOC	Northrop Corp.
MIC	Microdot, Inc.	NOI	Nokia
MID	Microfix Instruments, Ltd.	NOR	Northeast Medal Industries
MIE	Mitre Corporation	NOV	Nova-Tech/Avionics or Nova Tech Inc.
MIL	Micro-Link Corp.	NRA	Northern Radio Co. or Northern Electronic Co.
MIN	Midland Int'l. Corp.	NRB	NARCO
MIT	Minatronics Corp.	NRC	National Aeronautic Corp.
MIW	Microwave Associates, Inc.	NSI	Nady System, Inc.
MKY	Mackay Radio-Telegraph Co.	NSM	News And Sports Microwave
MLR	R. A. Miller Industries	NTA	Verint Systems Inc.
MMA	Martin Marietta Air Space	NUC	Nucomm
MMI	Microwave Monolithics Inc.	NUW	NuWaves Engineering
MML	Micromil Electronics, Ltd.	NVL	Novalynx Corp.
MMT	Millimeter Wave Technology	NVR	Novra Technologies Inc.
MNE	Mnemonics Inc.	<b>O</b>	
MNI	Microwave Network, Inc.	OAI	Oklahoma Aerotronics, Inc.
MNO	Microwave Innovations	OAQ	OAQ Corp.
MNT	Montec (Divn of E-Systems)	OAR	Ocean Applied Research Corp.
MOC	Model Rectifier Co.	OCA	Obstruction Collision Avoidance System Inc.
MOD	Modar Electronics	OMB	OMB Sistemas Electronicos S.A.
MOE	Monaco Enterprises, Inc.	OMN	Omnitek
MON	Monitor Electronics	OPH	Ophir

OPS	Opos Electronics	RAY	Raytheon Co. or Raytheon Manufacturing Co.
OSC	Orbital Sciences Corp.	RCA	Radio Corporation of America
OSL	Orbital Systems, LTD	RCE	R3 Engineering
OTX	Omni Tronix	RCN	Racon, Inc.
<b>P</b>		RDA	Radair, Inc.
PAD	Pacific Advanced Engineering, Inc.	RDC	Raven Defense Corp.
PAE	Park Aire Electronics	RDE	Radtec Engineering
PAS	Park Air Systems	RDL	Redline Communications, Inc
PAU	Pauldon	RDN	Raydyne, Inc.
PAV	PAVCO	RDR	RDRTec Inc
PCM	Pacific Communications	RDW	Radio Waves Inc.
PCR	Pacific Crest Corp.	REG	Ross Engineering
PCS	Proportional Control Systems	REI	Regency Electronics, Inc.
PDL	Paradise Datacom LLC/LTD	REL	Radio Electronics Laboratories
PEA	Pearce Simpson, Inc.	REP	Repco, Inc. or R.G.P. Co.
PEG	Peninsula Engineering Corp.	REU	Reutech
PER	Persistent System	RFC	RF Communications Associates, Inc.
PFE	Professional Electronics	RFE	Rafael
PHI	Philco Corp.	RFI	Radio Frequency Communications, Inc.
PHX	Phoenix Contact	RFT	R. F. Technology
PLE	Plessey Company, Ltd. (UK)	RGC	Ranger Communications
PMH	Pacific Microwave Research	RHG	RHG Electronics Laboratories
PMX	Primex Wireless Clock System	RHT	Radio Hill Technologies
POE	Pointer Electronics	RIE	Rockwell International Electronics
PPI	Peter Pepper Inc.	RIT	Ritcon, Inc.
PRI	Polytronics Research, Inc.	RMC	Relm Communications, Inc.
PRL	Polar Research Lab.	RMO	Ramona Research
PRM	Protium Technologies Inc.	RMT	Remotec, Inc.
PRO	Podelin, Inc.	RMX	Radiometrix
PRS	Prosensing Inc.	ROC	Recon Optical, Inc.
PRT	Pitchard Brown	ROE	Robinson Engineering Co.
PRX	Poxim	ROS	Rohde Schwarz
PSI	Planning Systems Incorporated	ROT	Rothenbuhler Engineering
PST	Pwer Systems Technology, Inc.	RQM	Racon, Inc. Quality Microwave
PTI	Ptection Technology, Inc.	RRC	Radio Receptor Co.
PTK	PTEK Corporation	RSI	Radio Systems, Inc.
PTN	Peraton Labs	RSM	Radio Specialty Manufacturing
PYR	Pyramid Co.	RSS	RS Systems, Inc.
<b>Q</b>		RTK	REFTEK
QEI	QEI Corp.	RTL	RT Logic
QEN	Quadrant Engineering, Inc.	RTR	Ritron, Inc.
QNA	Qinetiq North America	RWC	Rockwell, Collins
QUA	Qualimetrics Corp.	<b>S</b>	
QUC	QALCOMM	SAB	SAAB
QUI	Quintron Corp.	SAC	Sabre Communications Corp.
QUS	Quasonix Systems	SAD	Sandia Corp.
QUT	QUALI-TRON	SAL	Salco Manufacturing Co.
QWC	Quarterwave Corp.	SAT	Sarkes Tarzian, Inc.
<b>R</b>		SCA	Scala Radio Corp.
RAC	Racal Communications, Ltd.	SCC	Secode Corp.
RAD	Radiation, Inc.	SCE	Sericore
RAE	Racal Electronics, Ltd.	SCI	Scientific Atlanta Co.
RAG	Radian Corp.	SCM	SCM Melabs, Inc.
RAI	RADA Electronics Industries	SCN	Scintec Corporation
RAJ	Ray Jefferson Co.	SCT	Science Applications International Technology, Inc.
RAM	Raymarine Inc.	SCX	Sensor Concepts Inc.
RAN	Rantec Corp.	SDC	Space Data Corporation
RAS	Radio Shack	SDI	Safety Devices, Inc.
RAV	Raveon Technologies	SEA	Sears Roebuck Co.
RAW	Radwin		



SEC	Struthers Electronics Corp.	STB	Standard Communications
SEI	Seiscor Manufacturing Co.	STC	Sagotech Corp.
SEL	Selenia S.P.A. (Italy)	STD	Standard Elektrik Lorenz
SEM	Seatron, Inc.	STE	Stephenson
SEN	Sennheiser Electronic Corp.	STN	ST Engineering
SEO	SEMCO	STM	ST Microwave
SEP	Shakespeare Electronic Product Group	STR	Stromberg Carlson Products Co.
SER	Servo Corp. of America	STS	Standard Electrica S.A.
SFC	Safecom (Radionics)	STW	Stewart Warner Corporation of Canada, Ltd.
SFI	Stanford Telecommunications, Inc.	STX	SI-Tex Marine Electronics, Inc.
SGC	Sperry Gyroscope Company of Canada, Ltd.	STY	Sensor Technology Systems, Inc.
SHU	Shure Brothers, Inc.	SUM	Summers & Mills
SIC	SRI International	SUN	Sunair Electronics, Inc.
SID	Sierra Digital	SUR	Sur-Tec, Inc.
SIE	Sierra Electronic Division of Philco	SUT	Sutron Co.
SIG	Signal Communications	SWM	Southwest Microwave Co., Inc.
SIH	Siemens-Halske	SWR	Southwest Research Institute
SII	Sirit Corp	SYA	Syracuse Research Corp.
SIK	Siklu Communications Ltd.	SYE	Systems Engineering & Management Corporation
SIL	Silvus Technologies Inc.	SYL	Sylvania Electronics Defense Laboratory or Sylvania Electronics Products
SIM	Simpson Electronics	SYN	Synergetics
SIN	Spectrum Communications, Inc.	SYS	Systron Donner Corp (Demornay Bonardi)
SIP	Sippian Ocean Systems		
SIR	Sitra		
SLI	Silicon Laboratories		
SMN	Summation Research, Inc.	T	
SMO	Sierra Misco	TAC	Technical Appliance Corp.
SMT	Samson Technologies Corp.	TAE	Tait Electronics, Ltd.
SMW	Southern California Microwave	TBL	Trimble Navigation
SNC	Sierra Nevada Corp.	TBN	Tayburn
SNI	Seamarine International	TCD	Techdyn Systems Corp.
SNS	Senstar Corp.	TCM	TCOM Industries, Inc.
SOA	Southern Avionics	TCT	Transcidronic
SON	Sonar Radio Corp.	TDC	Teledyne T/M Co.
SOV	Soviet Manufactured Equipment	TDI	TeleDesign
SOY	Sony	TDL	Tidelands
SOZ	Southcom International, Inc.	TDY	Tele-Dynamics
SPA	Spar Aerospace, Ltd.	TEC	Telviso Electronics
SPB	System Planning Co.	TED	Teldex
SPD	Sperry Corp.	TEI	Texas Instrument, Inc.
SPE	Space Electronics	TEL	Telrex Laboratories
SPI	Spirent	TEN	Teletronix Engineering Co.
SPN	Sparton Electronics	TEO	Telemotive
SPO	Spotter RF	TEP	Tepco Corp.
SPR	Sperry Corp. or Servo Corporation of America	TEQ	Tenna Corp.
SPX	SpaceX	TER	Terra-Com
SPZ	Sperry Marine Systems	TES	Technisonic Industries
SQA	Square D Co.	THA	Thales ATM
SQL	Spacequest LTD	THC	Thomson CSF
SRC	Schuberth Rider Communication	THY	Technology Service Corp
SRE	Systems Technology Research	TIA	Television Technology Corp.
SRM	Sierra Monolithics, Inc.	TIE	Tel Instrument Electronics
SRS	Scientific Radio Systems, Inc.	TII	Teledyne Industries, Inc.
SRU	SATEL Radio USA	TIL	Transcript International
SSA	Selex Sensors and Airborne Systems Ltd.	TIM	Time Domain Corporation
SSN	Sensis Corp.	TIN	Telinstrument Co.
SSR	Sensor Systems	TIS	Tadiran Israel Industries, Ltd.
SST	Surrey Satellite Technology	TKL	Teklogix, Inc.
SSY	Stellar System	TKM	TEK Mark Company
STA	Standard Electronics	TKT	Turnkey Technology
		TLA	Telonica Corp

TLC	TRT Groupe	VAL	Valcom, Ltd.
TLF	Telefunken Gmbh.	VEC	Vector Manufacture Co.
TLP	Telephonic Corp.	VEG	Vega Electronics Corp.
TLR	Telline Radio	VER	Versa-Count
TLX	Telex Co.	VEX	Vertex Communications Corp.
TMA	Tampa Microwave	VHF	VHF Engineering Co.
TMC	Technical Materiel Corp.	VIA	Victoreen Instrument Co.
TMD	TMC Systems & Power Corp. or Telemotive Division of Dynascan	VIL	Vitel
TMN	Tallysman	VIS	Visual Manufacturing Division
TMR	Terma Elektronik	VIT	Vitro Electronics
TNC	Technocom	VIX	Vista Manufacturing Co.
TNI	Telenetics Inc.	VIZ	VIZ Corp.
TNS	Telonics	VLK	VISLINK Plc.
TOA	Townsend Associates	VST	Viasat Technologies Co.
TPL	Technology Proprietary, Ltd.	VSX	Visiplex
TRA	Transco Products, Inc.	VTC	Vectran Corp.
TRB	Trans World Communications, Inc.	VTX	Vortex Systems
TRC	Terrasat Corporation Inc.	VYT	Vytek, Inc.
TRI	Tracor, Inc.	<b>W</b>	
TRL	Trollsystems Corp.	WAT	Washington Technological Assn., Inc
TRM	Tram/Diamond Corp.	WAV	Wavetek
TRN	Tran-Com	WBL	Weibel Scientific, Inc.
TRP	Tri-Com, Inc.	WEI	Ward Electronic Industries
TRW	TRW Electronics	WES	Westinghouse Electric Co.
TRZ	Travelers Information Services, Inc.	WHD	Windermere HDS
TSB	Transcience	WHE	Whelen
TSC	Teledyne Systems Co.	WIL	Wilcox Electric Corp.
TSI	Tactical Systems, Inc.	WIN	Wind Data
TSS	Telesystems, Inc.	WJO	Watkins Johnson Co.
TST	Triasys Technologies	WLC	Wilson Electronic Corp.
TTC	Titian Corp.	WMX	Western Multiplex Corporation
TTG	Telectronics Technology Corporation	WOD	Wood and Douglas
TTK	Tron-Tek, Inc.	WOU	Quanzhou Wouxun Electronics Co., LTD.
TTS	Telesciences Transmission System, Inc.	WRL	World Radio Laboratories
TTT	Tactical Technology, Inc.	WUL	Wulfsberg Electronics
TWS	Tracwell Systems Inc.	<b>X</b>	
TWT	Trellisware Technologies Inc.	XCM	Xicom Technology
TYC	Tycho-Tech	XON	Xontech, Inc.
<b>U</b>		XTR	Xetron Corp.
UAV	Uavionix Corporation	XWV	Xetawave LLC.
UBI	Ubiquiti Networks Inc.	<b>Y</b>	
UBL	Ublox	YDI	Yarnell Data, Inc.
UDN	Uniden	YEA	Yaesu
ULT	Ultra Electronics 3ETI	<b>Z</b>	
UNI	Univac Corp.	ZDS	Zodiac Data Systems
UNS	Unisys Corp.	ZEP	Zephyrus
USE	Use Corporation	ZET	Zeta Laboratories
USN	Universal Space Network Inc.	ZVA	Ziva Corporation
<b>V</b>			
VAI	Vaisala		

## G.6 ANTENNA ABBREVIATIONS

This section of Annex G contains those antenna abbreviations that will be used in the XAD and RAD fields of the GMF (see Section 9.8.2, 29.b(4b) and 9.8.2, 38.b(4b)).

ANTENNA NAME	ABBREVIATION
Alford Loop	ALFORDLOOP

ANTENNA NAME	ABBREVIATION
Annular slot	ANULARSLOT

ANTENNA NAME	ABBREVIATION
Batwing	BATWING
Biconical	BICONICAL
Biconical Dipole	BICONCLDPL
Blade	BLADE
Bowtie	BOWTIE
Cassagrain	CASSEGRAIN
Cavity Array	CAVITYARRAY
Coaxial Collinear	COAXCOLLNR
Coaxial Dipole	COAXDIPOLE
Collinear	COLLINEAR
Collinear Array	COLLNRARRAY
Conformal Array	CNFRMLARRAY
Conical	CONICAL
Conical Horn	CONICALHRN
Corner Reflector	CORNREFLTR
Cross Dipole	CROSSDIPOL
Cross Dipole Reflector	CRDIPOLERF
Dielectric Lens	DLCTLENSES
Dipole	DIPOLE
Dipole Array	DIPOLEARRAY
Discone	DISCONE
Dual Log Periodic	DUALLGPRDC
Dual Yagi	DUALYAGI
Folded Coax	FOLDEDCOAX
Folded Dipole	FOLDDIPOLE
Folded Monopole	FOLDMONOPL
Ground Plane	GROUNDPLAN
Half Parabolic	HALFPARBOL
Helical	HELICAL
Helical Array	HELICALARY
Helicone	HELICONE
Helix	HELIX
Helix Array	HELIXARRAY
Horn	HORN
Leaky Coax	LEAKYCOAX
Linear Array	LINEARARRAY
Log Periodic	LOGPERIODC
Longwire	LONGWIRE
Loop	LOOP
Loop Array	LOOPARRAY
Microstrip	MICROSTRIP

ANTENNA NAME	ABBREVIATION
Microstrip Array	MCRSTRPARY
Monopole	MONOPOLE
Monopole Array	MONOPLARRAY
Panel	PANEL
Parabolic	PARABOLIC
Parabolic Cylinder	PARABLCCYL
Patch	PATCH
Patch Array	PATCHARRAY
Phased Array	PHASEDARRAY
Phased Array Waveguide	PHSDARYWVG
Pillbox	PILLBOX
Planar	PLANAR
Planar Array	PLANARARRAY
Radiac Cable	RADIAX
Reflector	REFLECTOR
Rhombic	RHOMBIC
Skeleton Slot	SKELTNSLOT
Slot	SLOT
Slot Array	SLOTARRAY
Slotted Waveguide	SLOTTDWVGD
Slotted Waveguide Planar Array	SLTWGPLNRA
Spherical Reflector	SPHRCLFLCT
Spiral	SPIRAL
Stacked Array	STACKDARRAY
Stacked Cross Dipole	STKCRSDPL
Stacked Dipole	STCKDIPOLE
Stacked Yagi	STACKDYAGI
Strip Line	STRIPLINE
Stub	STUB
Swastika	SWASTIKA
Symmetrical Tee	SYMMETRCTE
Tophat	TOPHAT
Tower	TOWER
Turnstile	TURNSTILE
V Ring	VRING
Waveguide	WAVEGUIDE
Waveguide Array	WAVEGDARRAY
Whip	WHIP
Yagi	YAGI
Yagi Array	YAGIARRAY

**(Last Page in Annex G)**

**Annex H**  
**(RESERVED)**

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## Annex I

# Procedure for Evaluating Frequency Proposals in the 162-174 MHz and 406.1-420 MHz Bands

## I.1 PROCEDURE FOR EVALUATING FREQUENCY PROPOSALS IN THE 162-174 MHZ AND 406.1-420 MHZ BANDS

1. The purpose of this procedure is to evaluate potential interference involving Fixed and/or Mobile stations in the 162-174 MHz and 406.1-420 MHz bands. The propagation portion of the discussion was derived from the Longley-Rice Model (1968). Certain assumptions have been made in the propagation calculations for ease of presentation and use. In all cases, the assumptions used will result in conservative estimates of propagation loss, i.e., the actual interfering signal level should be less than that predicted.

2. The data used to indicate the rejection off-tuned interfering signals is based upon characteristics of recent model VHF/UHF signal channel FM voice receivers using crystal lattice type IF filters. The curves used are the adjacent channel selectivity and desensitization data taken in accordance with the latest revision of EIA/TIA-603.

### STEP 1. *Choose an Interfering Threshold*

Using Figure 1, if necessary to convert from V to dBW, choose an appropriate criteria for acceptable interference. This will depend to a large extent on the RF noise environment in which the receiver operates. Several typical values are indicated on Figure 1. Enter the chosen interference threshold on Table 1.

### STEP 2. *Enter Transmitter Power*

Using Figure 2, if necessary, enter the interfering transmitter power in dBW on table 1.

### STEP 3. *Enter Antenna Gains*

Enter the antenna gains in dB above a dipole (dBd) of the interfering transmitter and your receiver. If the antennas are not omni directional, an estimate must be made of the respective antenna gains along their common line of direction.

### STEP 4. *Determine Propagation Loss*

By the use of Figures 3 thru 9 determine an estimate of the propagation loss between the antennas. The first step is to determine the mean height (i.e., geometric mean) of the two antennas. This is found by use of either the nomogram or equation shown on Figure 3. Next, using the appropriate curves from Figures 4 through 9, the propagation loss is estimated for the given mean antenna height and distance separation. Enter the value on Table 1.

### STEP 5. *Enter Additional System Loss*

Enter into Table 1 any additional known system losses at both the transmitter and receiver such as that due to coaxial cables, cavity filters, isolators, etc. If not known, enter zero. The use of zero will further slant the predictions towards conservative results.

### STEP 6. *Enter Off Frequency Rejection*

If the interfering transmitter and the receiver are separated in frequency between 0 and 25 kHz, additional losses may be included to account for off frequency rejection. Figure 10 is provided as a guide to determine this value. The four curves show the adjacent channel selectivity and desensitization for: Analog to Digital, Digital to Digital, Digital to Analog, and Analog to Analog systems. Select the appropriate curve for the case being modeled and enter the resulting value in Table 1. Non-synthesized equipment will normally give an additional 5 dB of selectivity for offsets equal to or greater than 25 kHz. If this is the case of the system being modeled, add 5 dB to the value selected from

the curve.<sup>1</sup>

**STEP 7. Calculate Predicted Received Signal**

Total the values entered on Table 1 observing plus and minus signs as appropriate. The resultant predicted value of received signal compared with the chosen interference criteria will indicate the likelihood of interference.

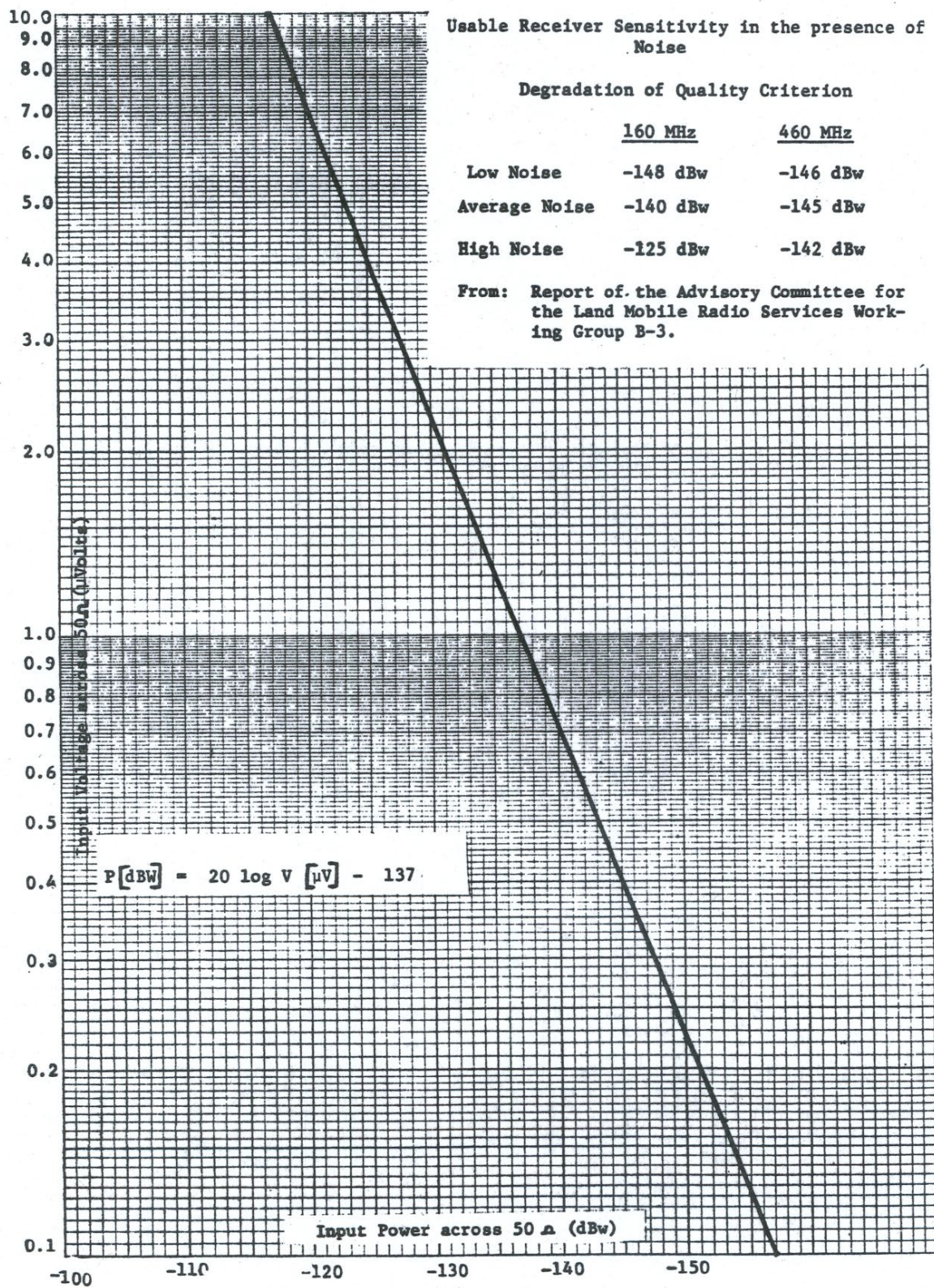
TABLE 1	
Transmitter Power	+ dBW
Transmitter Antenna Gain	+ dBd
Receiver Antenna Gain	+ dBd
Propagation Loss	- dB
System Losses	- dB
OFF Frequency Rejection	- dB
A. Predicted Received Power	dBW
B. Chosen Interference Threshold	dBW
If A is greater than B, unacceptable interference may result.	

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<sup>1</sup> Data supporting Figure 10 was taken from NTIA TM-87-122 and TM-88-137.

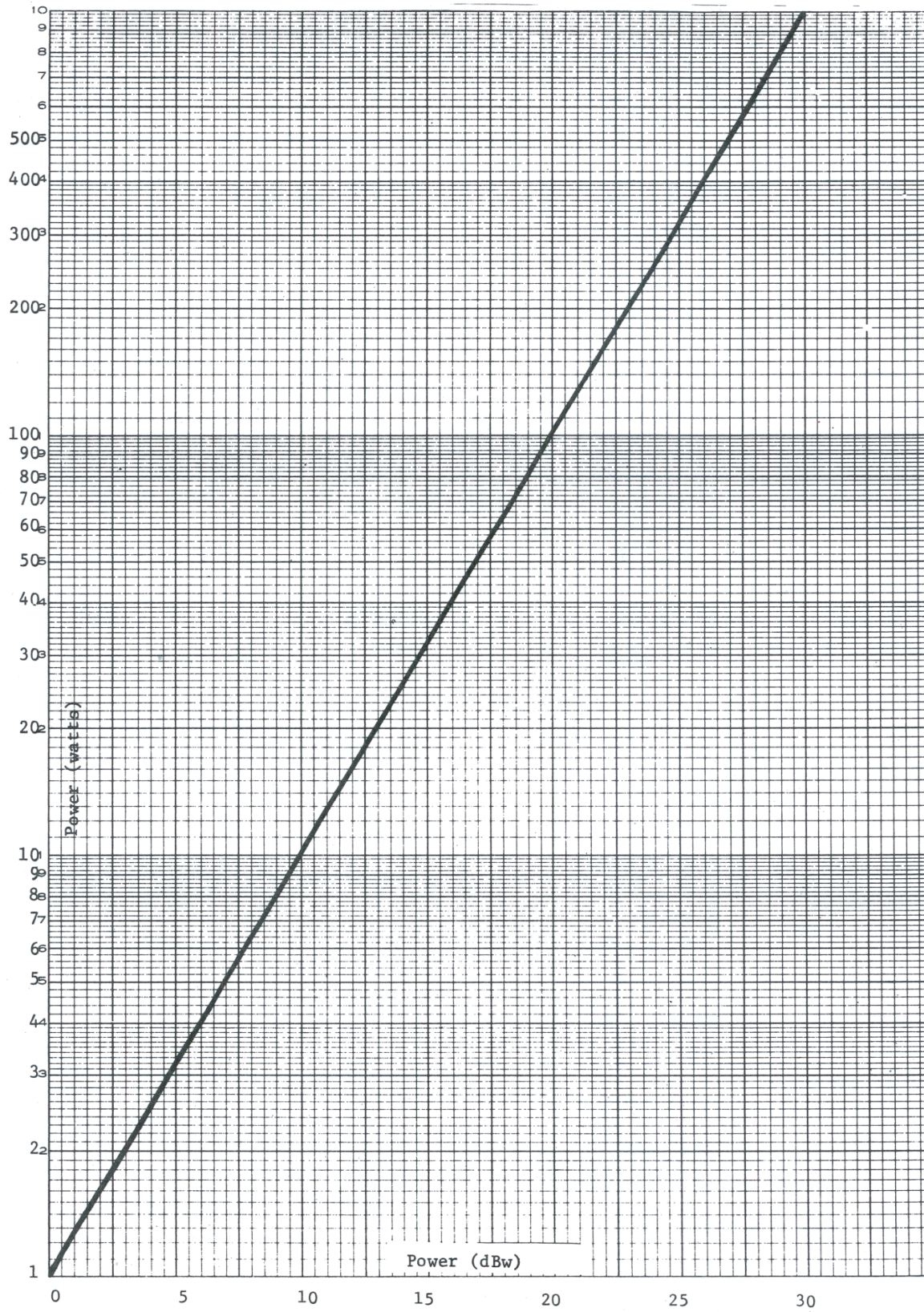


Figure 1: Voltage to Power Conversion





**Figure 2: Power to dBw Conversion**



**Figure 3: Calculations of Mean Antenna Height**

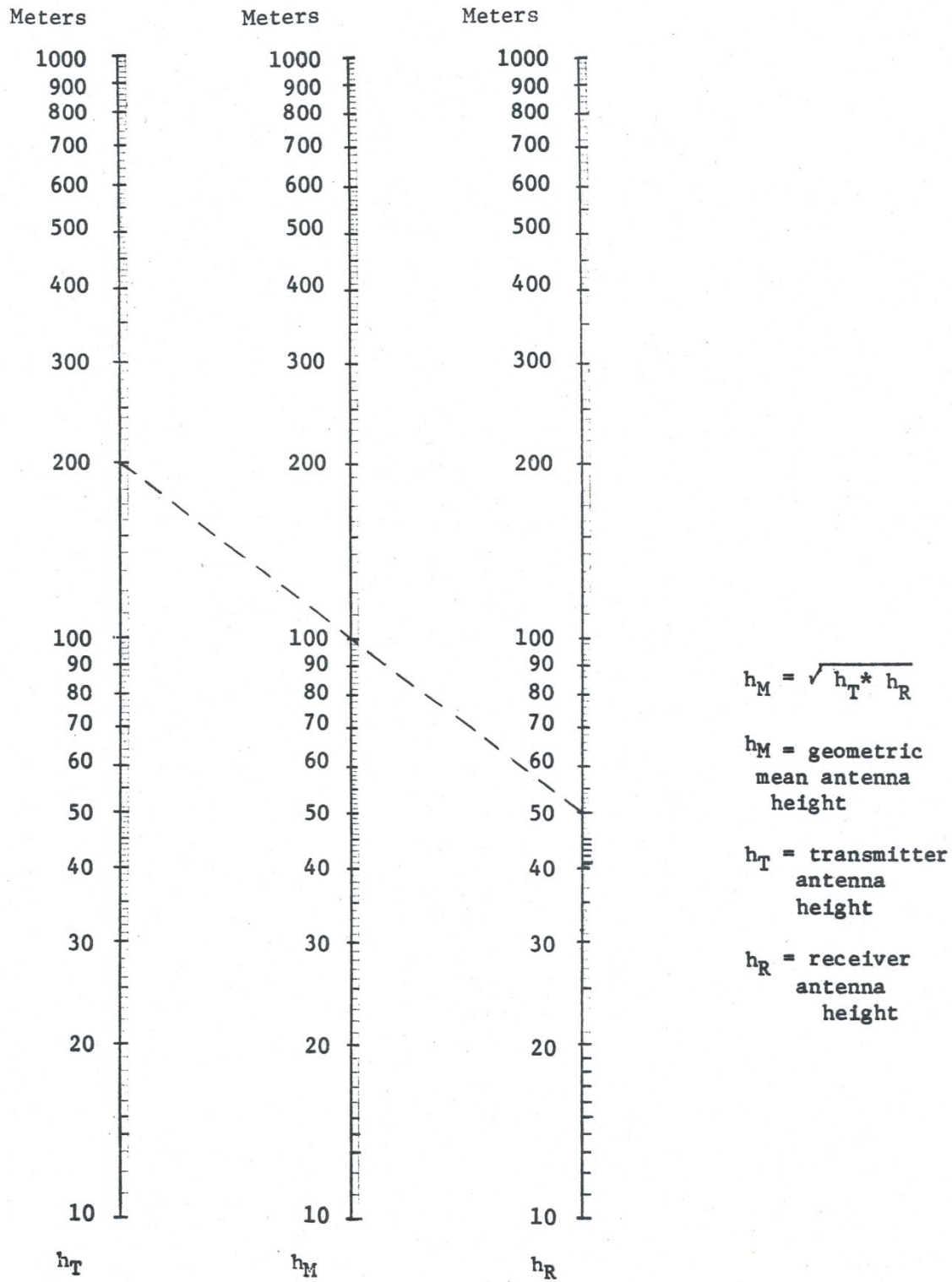




Figure 4: Propagation Loss for 168 MHz, Average Land

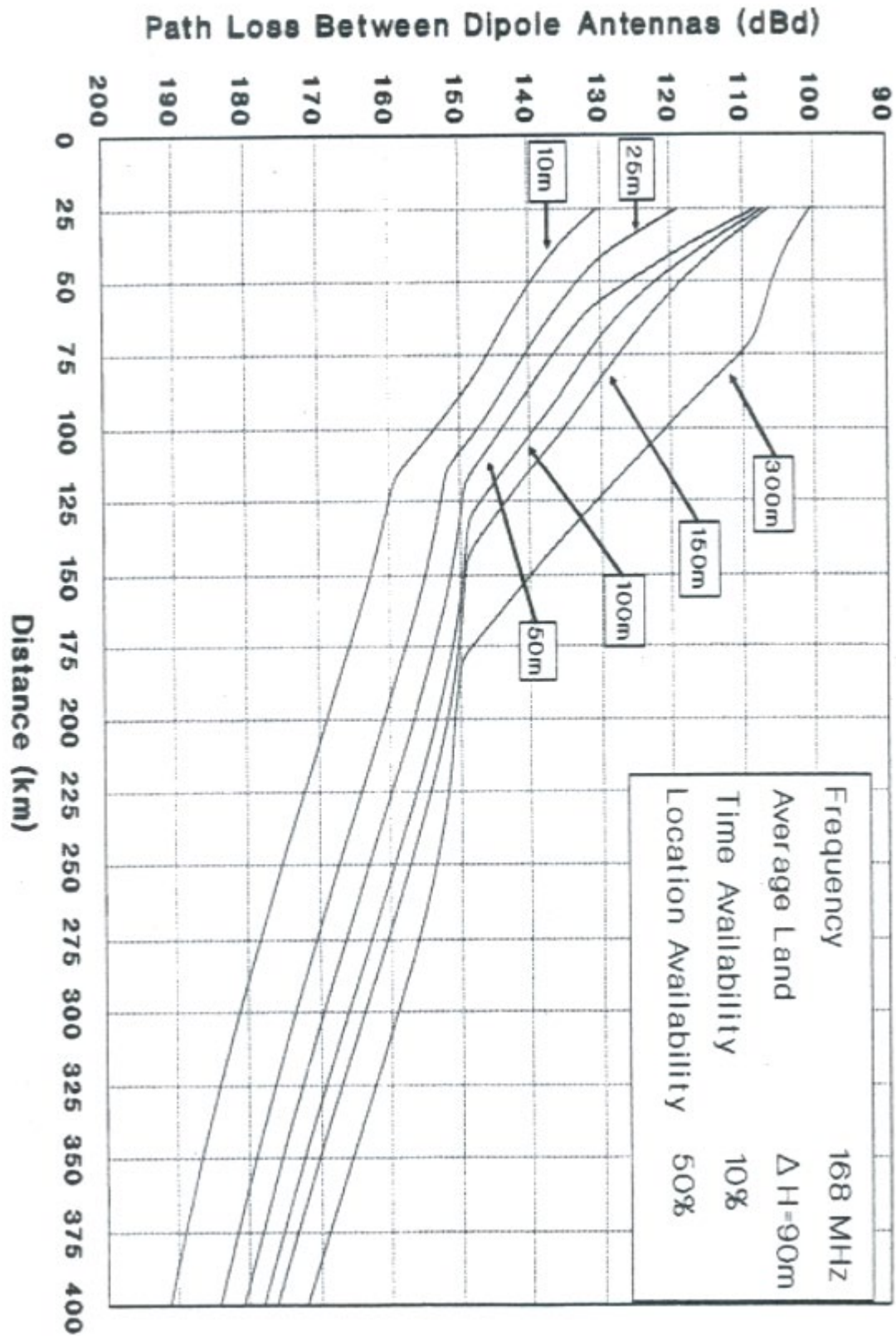


Figure 5: Propagation Loss for 413 MHz, Average Land

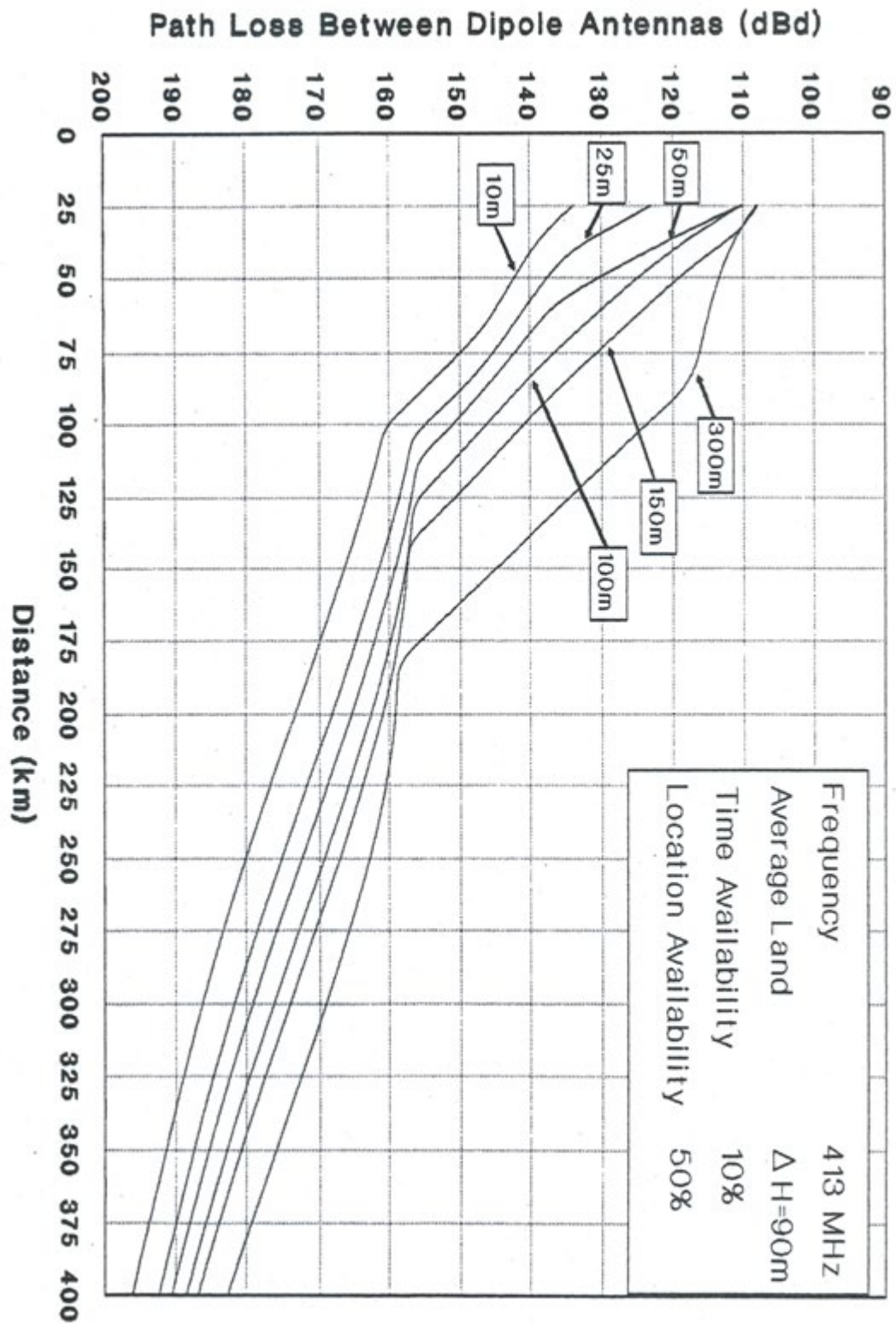


Figure 6: Propagation Loss for 168 MHz, Fresh Water

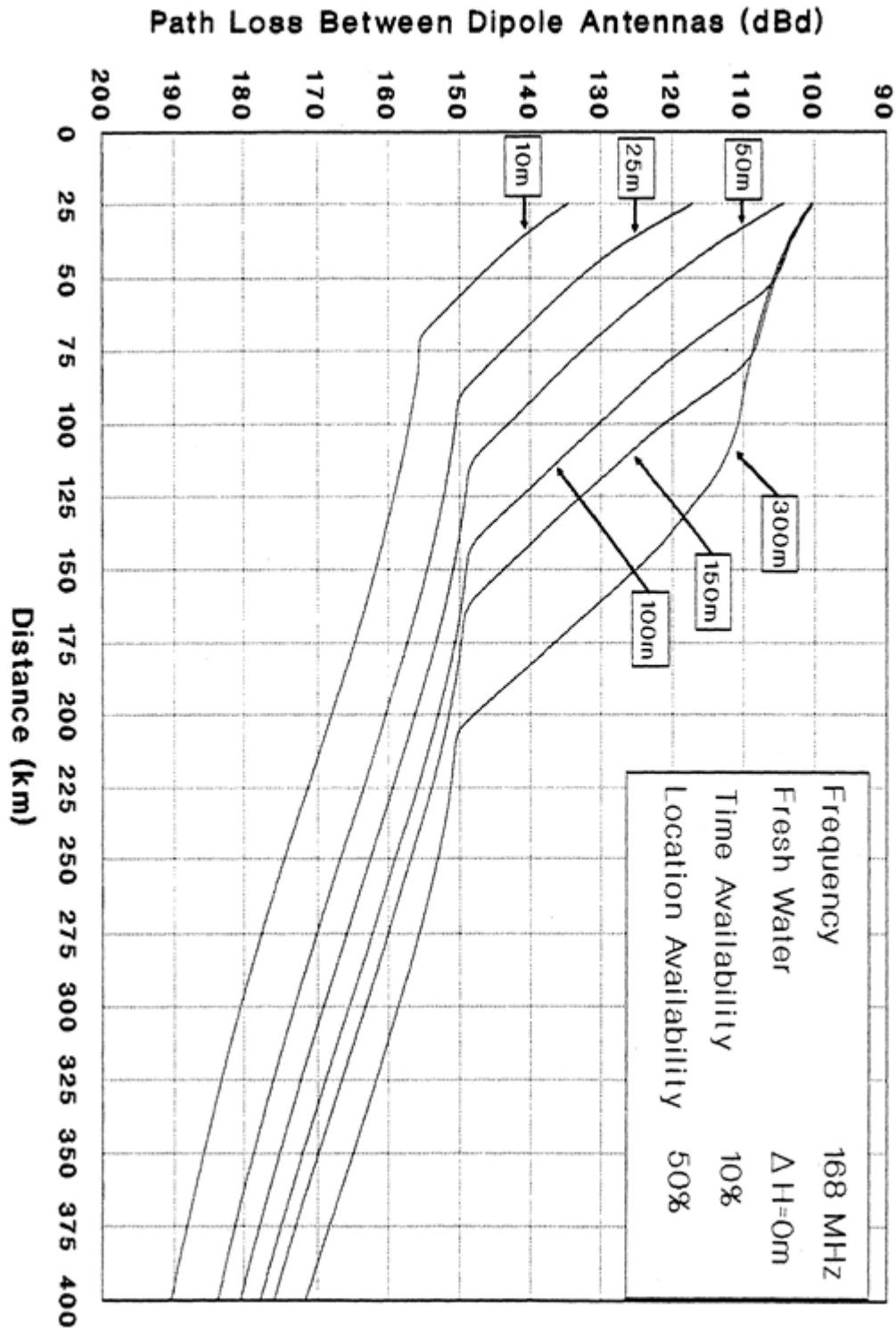


Figure 7: Propagation Loss for 413 MHz, Fresh Water

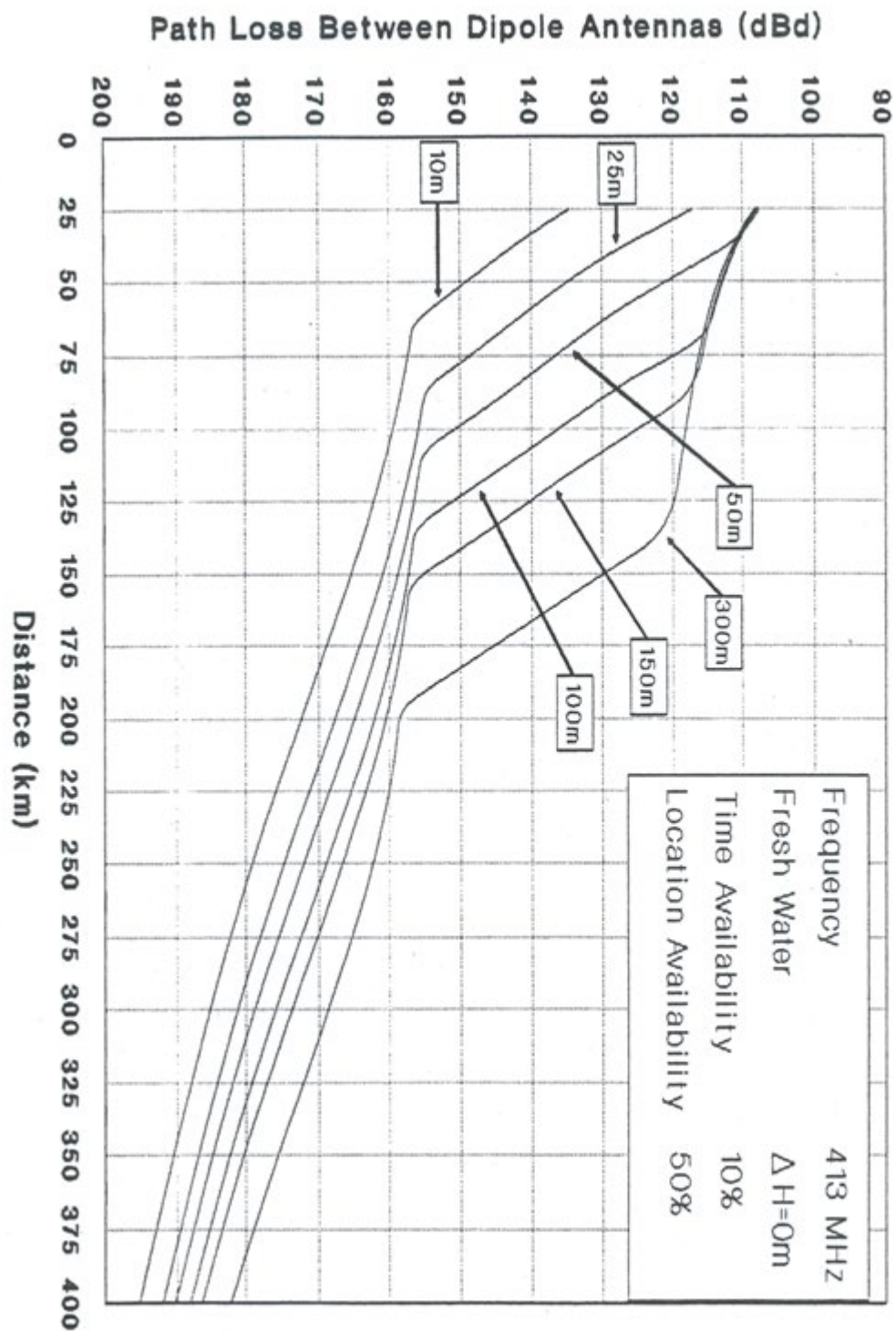




Figure 8: Propagation Loss for 413 MHz, Salt Water

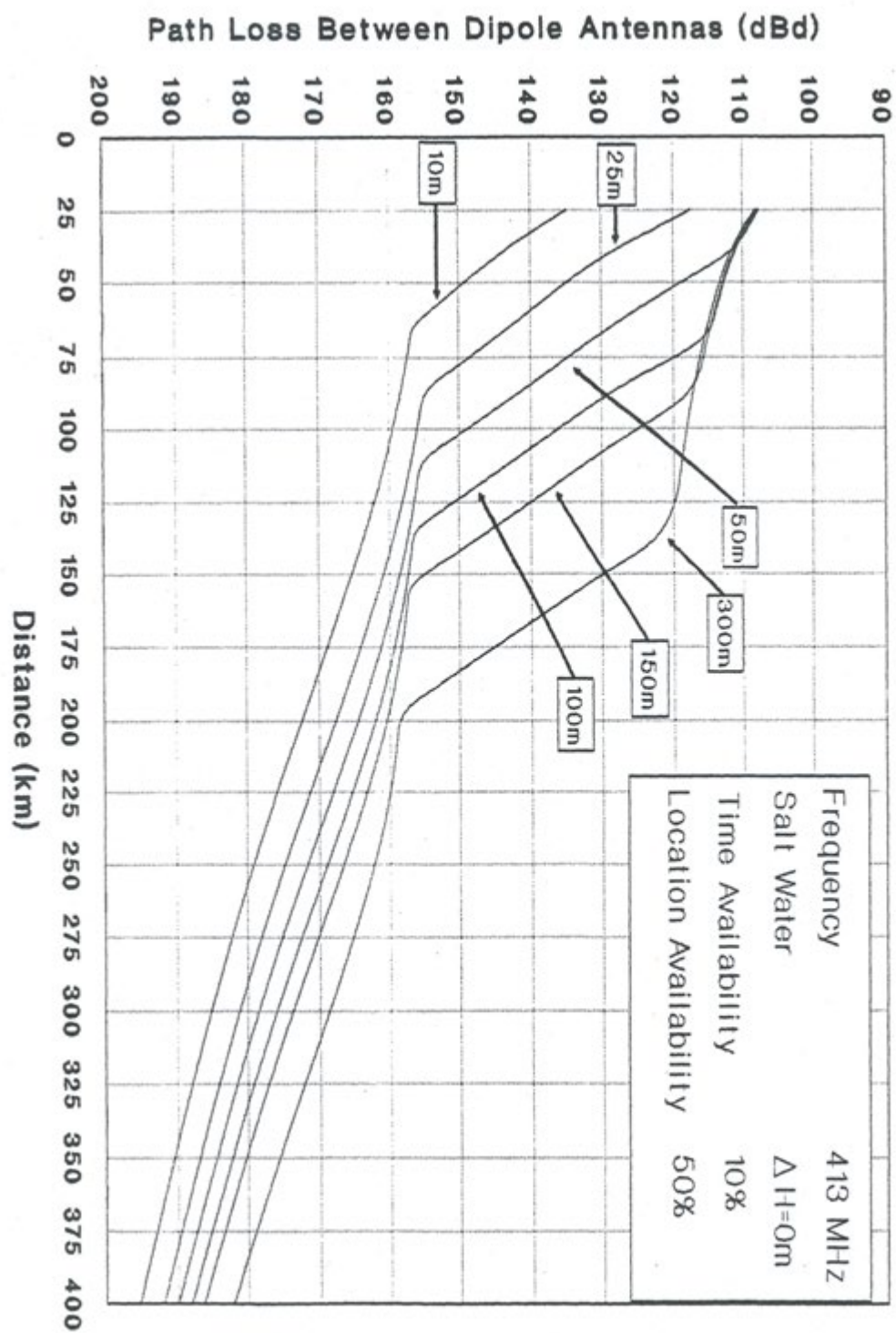
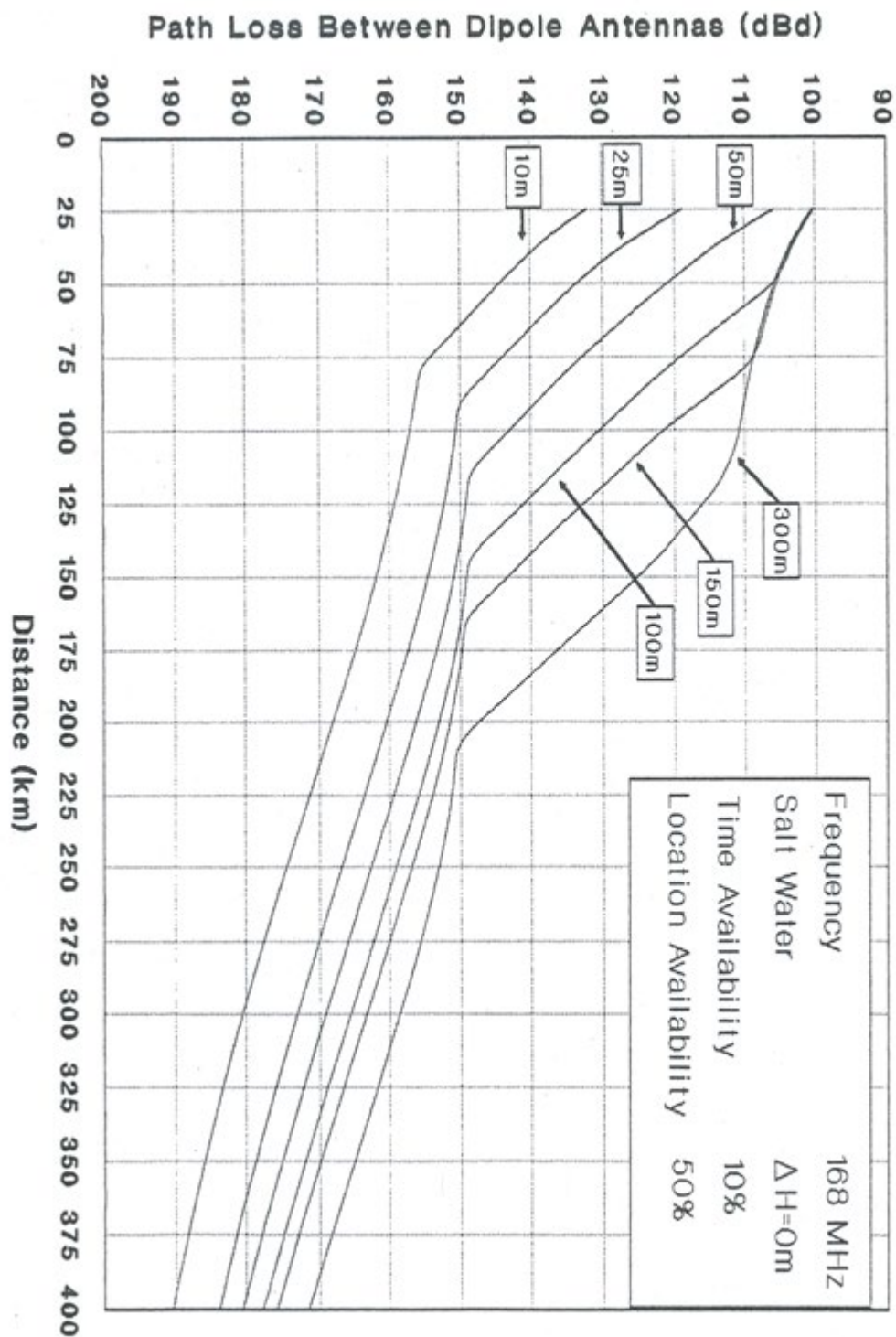
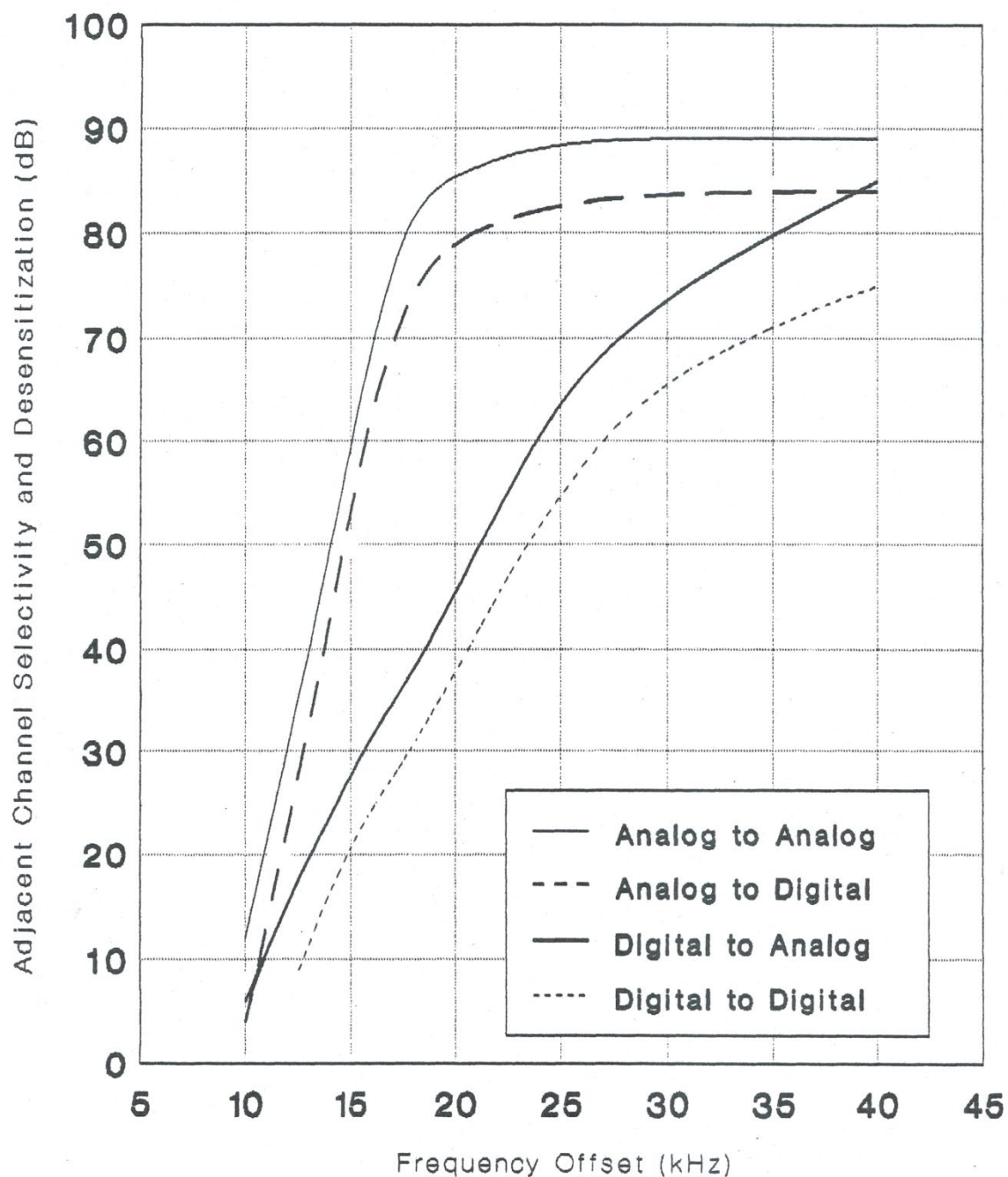




Figure 9: Propagation Loss for 168 MHz, Salt Water



**Figure 10: Adjacent Channel Selectivity and Desensitization**



## APPENDIX

### Determination of Propagation Loss

1. For purposes of this procedure, the prediction of path loss between antennas was based on the methods described by Longley and Rice (1968). That report discusses a computer method for predictions of long-term median radio transmission over irregular terrain. The method is based on well established propagation theory and has been tested and validated against a large number of propagation measurements.

2. This model is statistical in nature and is most useful over paths where specific coordinates of the endpoints

are not known. The program does require knowledge of general atmospheric and terrain parameters. One principal atmospheric parameter is the surface refractivity which largely determines the degree of bending of the radio wave through the atmosphere. A convenient method of accounting for this refracting of the radio wave is by assuming that the earth has an effective radius larger than its actual value. The value used here is an effective earth radius of 4/3 the actual size. A second atmospheric parameter to be specified is the general climate type. A continental temperature climate was assumed.

3. Three principal terrain dependent factors are used in the model; ground conductivity ( $\sigma$ ), ground dielectric constant ( $\epsilon$ ) and a terrain roughness factor ( $\Delta h$ ). The first two are constants which depends on electrical characteristics of the surface over which the radio waves propagate with the following values assumed:

	( $\sigma$ )	( $\epsilon$ )
Average ground	0.005 mho/m	15
Fresh Water	0.01 mho/m	81
Salt Water	5.0 mho/m	81

4. The terrain roughness factor is a parameter to describe the general irregularity of the surface. When surface endpoint locations are known, the ( $\Delta h$ ) can be calculated from a terrain profile drawn between the points. Specifically, a straight line is drawn on the profile such that 10% of the points lie above the line. Similarly, a line is drawn with 10% of the points below the line. The ( $\Delta h$ ) is the difference in elevations between these lines. When terrain profiles are not available, estimates of ( $\Delta h$ ) may be obtained from the following:

Type of Terrain	( $\Delta$ ) in Meters
Water	0-5
Smooth Plains	5-20
Slightly Rolling Plains	20-40
Rolling Plains	40-80
Hills	80-150
Mountains	150-300
Rugged Mountains	300-700
Very Rugged Mountains	> 700

5. For this procedure, a  $\Delta h$  of 0 was used for water and 90 meters used as average land somewhat typical of the Eastern rolling hills.

6. Specific parameters for the radio link include frequency, polarization, antenna heights and a general siting criteria. Since antenna heights for both transmitter and receiver are variable, a very extensive family of curves would be required to consider all possible combinations. A more simplified approach was taken in which the geometric mean of the two antennas is calculated. The ARPROP model is then exercised using this mean antenna height at both ends of the path. Thus, transmitter/receiver heights of 100/100 m or 50/200 m would both be represented as 100 m (see figure 3). This approach greatly reduces the required number of curves while introducing only small differences in the results with the more exact approach. Moreover, such differences always result in conservative estimates of propagation loss.

7. A general siting parameter is also an input parameter to the model as either being random siting, careful siting or very careful siting. The former is most applicable to mobile equipment whereas the latter two are applicable to fixed or base stations where advantage is often taken of hilltops. In these cases the effective height of the antennas are increased somewhat above the actual height. Careful siting was chosen for the calculations used in attachment 1 since, in general, the results will be used for base or fixed stations.

8. The results of the model provide propagation loss estimates versus distance as a statistical function of both time and location. The time variation represents the long term variations of the median propagation loss such as daily and seasonal changes. Short term fading statistics are not included. The location variation statistic accounts for the fact that propagation loss over two paths of equal length but different locations will, in general, differ. These differences are represented statistically by a distribution of values around a median value (50 percentile) and any

other desired value. For purposes of this procedure, values of 10% and 50% were chosen for the time and location parameters. The 10% value implies that the actual propagation loss is expected to be lower than the predicted value only 10% of the time on a long term basis. The 50% value for the location variability implies simply a median or average value. It is noted that these values are the same as those used by the Federal Communications Commission for similar propagation predictions used in interference calculations.

## **REFERENCES**

1. Longley, A.G. and P.L. Rice (July, 1968) Prediction of Tropospheric Radio Transmission Loss Over Irregular Terrain-A Computer Method, ERL 79-ITS-67, Institute of Telecommunications Sciences, Boulder, Colorado.
2. Frazier, W.E. (October 1978) Operations manual for the APPROP Computer Model (Area Propagation) as Implemented at NTIA/Annapolis NTIA-TN-78-3.

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## Annex J

### Guidance for Determination of Necessary Bandwidth

#### J.1 INTRODUCTION

This Annex provides guidance for determining the necessary bandwidth of federal radiocommunication systems. Necessary bandwidth forms part of the emission designator used for frequency management purposes and is used as a parameter in spectrum standards, frequency assignments, spectrum certification, etc., throughout this Manual. The other portion of the emission designator, emission classification symbols, is defined in Paragraph 9.8.2.16 of this Manual. Necessary bandwidth in this Manual is defined as follows:

*“Necessary Bandwidth:* For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.”

#### J.2 GENERAL

1. Except for radars, the necessary bandwidth may be determined by one of the following methods with the order of preference shown:
  - a. Use of the appropriate formula from Section J.3 or Table A in this Annex.
  - b. Computation in accordance with the latest versions of Recommendations ITU-R SM.328, SM.853 or SM.1138.
  - c. Measurements of specialized modulations not covered by a. or b. above.
  - d. Use of the best available technical information from other sources.
2. For radars, the necessary bandwidth shall be determined at a point that is 20 dB below the peak envelope value of the spectrum ( $B_{20\text{dB}}$ ) by one of the following with the order of preference shown:
  - a. Computation in accordance with the radar formulas from Section J.3 or Table A in this Annex.
  - b. Results of actual measurements.
  - c. Use of the best available technical information from other sources.

#### J.3 DERIVATIONS

1. It is recognized that the determination of necessary bandwidth based on the above definition can sometimes be imprecise, especially since the “quality required” is often unavailable or vaguely defined. For analog modulation types, the necessary bandwidth is generally based on rules-of-thumb, such as Carson’s Rule (described later), that have been in use since the early days of radio. For digital modulations, the necessary bandwidth is generally based on a more precise measure of bandwidth – the theoretical 99% occupied bandwidth.<sup>1</sup> As described above, the necessary bandwidth for radars and other pulsed systems is based on the theoretical  $B_{20\text{dB}}$  bandwidth.

2. The discussion below provides the general methods and equations for determining necessary bandwidth followed by a list of symbols used and Table A containing a series of examples.

##### J.3.1 ANALOG AMPLITUDE MODULATION

1. For analog Amplitude Modulation (AM) systems, the necessary bandwidth ( $B_n$ ) is calculated as:

$$B_n = KM \quad \text{Reference Eq. J-1}$$

where K is a factor determined by the specific AM format and practical filtering constraints or established technical standards. M is the maximum modulation frequency. Typical K values for analog AM formats are provided below.<sup>2</sup>

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<sup>1</sup> See Section 5.1.5 for the desired relationship of measured occupied bandwidth to necessary bandwidth.

<sup>2</sup> “Spectra and Bandwidth of Emissions” Recommendation ITU-R SM.328-11, 2006, Geneva - <http://www.itu.int/pub/R-REC>  
January 2021 Edition (Rev. 1/2023) J-1 J.3.1

- |                                                 |               |                          |
|-------------------------------------------------|---------------|--------------------------|
| a. Single sideband, suppressed carrier (SSB-SC) | $K < 1$ ,     | <i>Reference Eq. J-2</i> |
| b. Single sideband, reduced carrier (SSB-RC)    | $K = 1$ ,     | <i>Reference Eq. J-3</i> |
| c. Single sideband, full carrier (SSB-FC)       | $K = 1$ ,     | <i>Reference Eq. J-4</i> |
| d. Vestigial sideband (VSB)                     | $1 < K < 2$ , | <i>Reference Eq. J-5</i> |
| e. Double sideband (DSB)                        | $K = 2$ ,     | <i>Reference Eq. J-6</i> |
| f. Independent sideband (ISB) (see below).      |               |                          |

2. For SSB-SC, an alternative equation is normally used as follows:

$$B_n = M - M_l \quad (\text{where } M_l \text{ is the lowest modulation frequency}) \quad \text{Reference Eq. J-7}$$

3. For VSB, the necessary bandwidth may also be expressed as:

$$B_n = M + M_{\text{res}} \quad (\text{where } M_{\text{res}} \text{ is the width of the residual sideband}) \quad \text{Reference Eq. J-8}$$

4. For ISB, the individual channels may be arranged in a DSB format, i.e., on both sides of the carrier or in an SSB format with all channels on one side of the carrier. For these ISB cases,  $B_n$  can be expressed as:

$$B_n = M_{\text{sum}} \quad (\text{where } M_{\text{sum}} \text{ is the sum of the } M \text{ for each channel}) \quad \text{Reference Eq. J-9}$$

for DSB, SSB-FC, and SSB-RC formats and for SSB-SC formats as:

$$B_n = M_{\text{sum}} - M_l \quad \text{Reference Eq. J-10}$$

5. For analog AM systems that use one or more subcarriers located above the baseband (including subcarriers that are angle modulated), the maximum modulation frequency is given by:

$$M = C_{\text{max}} + 0.5B_{\text{sc}} \quad \text{Reference Eq. J-11}$$

where  $C_{\text{max}}$  is the highest frequency subcarrier and  $B_{\text{sc}}$  is the bandwidth of the highest frequency subcarrier. By combining equations J-6 and J-11, the necessary bandwidth for double sideband analog AM with subcarriers, would then be:

$$B_n = 2C_{\text{max}} + B_{\text{sc}} \quad \text{Reference Eq. J-12}$$

Depending on the type of subcarrier modulation, the  $B_{\text{sc}}$  term can be determined using equations defined herein. For example, if the highest frequency subcarrier is an unmodulated tone, equation J-12 reduces to simply:

$$B_n = 2C_{\text{max}} \quad \text{Reference Eq. J-13}$$

If the highest frequency subcarrier is frequency modulated, then (see subsection C. below):

$$B_n = 2C_{\text{max}} + 2M + 2KD \quad (\text{where } D \text{ is the peak frequency deviation}) \quad \text{Reference Eq. J-14}$$

The necessary bandwidth for analog SSB systems with subcarriers is determined in a similar manner.

6. Typical values for  $M$  include:

$M = 2.7$ to $3.1$ kHz	Commercial quality voice
$M = 4$ to $10$ kHz	Broadcast quality voice & music
$M = 4.2$ MHz	Standard definition broadcast video

### J.3.2 ANALOG FREQUENCY MODULATION

1. The basis of the necessary bandwidth of analog Frequency Modulation (FM) systems is the long-established Carson's Rule as follows:<sup>3</sup>

$$B_n = 2M + 2KD \quad (\text{where } D \text{ is the peak frequency deviation}) \quad \text{Reference Eq. J-15}$$

2. In its fundamental form, Carson's rule uses a fixed value of  $K = 1$ , but there may be instances where a different value, higher or lower, is appropriate based on measurements. For analog FM systems using one or more modulated or unmodulated subcarriers above the baseband, combining equations J.11 and J.15 yields:

$$B_n = 2C_{\max} + 2M + 2KD \quad \text{Reference Eq. J-16}$$

3. In some cases where a variety of subcarriers is used, established standards may specify only that the composite  $M$  including the baseband, subcarriers, and all modulation products be limited to a specific value.<sup>4</sup> In this case the composite  $M$  is used to compute equation J-15.

4. Analog FM equipment using frequency division multiplex/FM (FDM/FM) techniques have been largely displaced by digital radios. Reference can be made to Recommendation ITU-R SM.853 for necessary bandwidth calculation methods for FDM/FM systems.<sup>5</sup> Values for  $M$  and  $D$  are often stated in terms of a Modulation Index (MI) where

$$MI = \frac{D}{M} \quad \text{and } 0.25 \leq MI \leq 5 \text{ (typically)}$$

5. Typical values for  $M$  include:

$M = 2.7$ to $3.1$ kHz	Commercial quality voice
$M =$ up to $15$ kHz	Broadcast quality high-fidelity voice and music
$M = 24$ kHz to $4028$ kHz	Frequency division multiplex (6 to 960 voice channels)
$M = 4.2$ MHz	Standard definition video links

### J.3.3 ANALOG PHASE MODULATION

Analog Phase Modulation (PM) is rarely used because of the more complex receiving hardware required. No examples of analog PM are included herein. If needed, an equivalent Carson's Rule for analog PM can be defined as:

$$B_n = 2(h + 1)M \quad (\text{where } h \text{ is the phase modulation index}) \quad \text{Reference Eq. J-17}$$

### J.3.4 PULSE CODE MODULATION/PM

The next several sections contain K-factors for Pulse Code Modulation (PCM)/PM unfiltered and baseband filtered, with and without subcarriers.

The next subsections show the K-factors for unfiltered PCM/PM without subcarriers, as well as a selective set of unfiltered PCM/PM with subcarrier, and a selective set of filtered PCM/PM. It is recommended that the unfiltered PCM/PM results be also used as upper bounds on filtered PCM/PM with similar settings. Note the K-factors are equal to  $BW_{95\%}/R$ , where  $R$  is the input data rate, and  $BW_{95\%}$  is the Two-Sided 95% power containment bandwidth. The input data rate  $R$  could include all source and channel encoding bits, such as error coding.

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<sup>3</sup> "Notes on the Theory of Modulation", Proceedings of the Institute of Radio Engineers, volume 10, issue 1, February 1922, pages 57–64.

<sup>4</sup> See for example 47 CFR 73.44 and 47 CFR 73.317 for commercial AM and FM broadcast station standards.

<sup>5</sup> "Necessary Bandwidth", Recommendation ITU-R SM.853-1, 1997, Geneva - <http://www.itu.int/pub/R-REC>

### **K-factors for Unfiltered PCM/PM:**

Tables 1-3) show the K-factors for unfiltered PCM/PM with NRZ, and Bi-Phi (or Manchester), with and without subcarriers (sinewave, and squarewave). The cases with subcarrier (Table 2 and Table 3) are limited and as such engineering judgment should be made on settings that differ from those listed (example choose the settings that are closest to the given subcarrier system, or averaging between two settings).

Note that the unfiltered cases are proposed for use not only for unfiltered PCM/PM, but also as upper bounds for filtered PCM/PM, when none of the selective filtered cases shown in the next subsection apply.

**Table 1: K-factors for PCM/PM Unfiltered without subcarrier**

Modulation Index	K-factor	
	PCM/PM NRZ	PCM/PM Bi-Phi
0.2	2x0.1	2x0.5
0.3	2x0.2	2x0.8
0.4	2x0.4	2x1.0
0.5	2x0.5	2x1.2
0.6	2x0.6	2x1.5
0.7	2x0.7	2x2.8
0.8	2x1.1	2x3.1
0.9	2x1.4	2x3.3
1	2x1.5	2x4.7
1.1	2x1.6	2x4.9
1.2	2x1.7	2x5.1
1.3	2x1.8	2x5.3
1.4	2x2.1	2x5.4
1.5	2x2.2	2x6.3
$\pi/2$	2x2.2	2x6.4

**Table 2: K-factors for PCM/PM Unfiltered with Squarewave Subcarrier**

Modulation Index (m)	K-factor		
	Subcarrier frequency (Fs) over data rate (R) ratio=(Fs/R)=3	Subcarrier frequency (Fs) over data rate (R) ratio=(Fs/R)=9	Subcarrier frequency (Fs) over data rate (R) ratio=(Fs/R)=15
0.4	2x4.8	2x11.9	2x16.7
1.2	2x23.8	2x61.9	2x104.8

**Table 3: K-factors for PCM/PM Unfiltered with Sinewave Subcarrier**

Modulation Index (m)	K-factor		
	Subcarrier frequency (Fs) over data rate (R) ratio=(Fs/R)=3	Subcarrier frequency (Fs) over data rate (R) ratio=(Fs/R)=9	Subcarrier frequency (Fs) over data rate (R) ratio=(Fs/R)=15
0.4	2x3.3	2x9.2	2x15.0
0.8	2x4.2	2x10.0	2x16.7
1.2	2x4.2	2x10.0	2x16.7
1.4	2x4.2	2x10.0	2x16.7



### **K-factors for Filtered PCM/PM without subcarrier**

The K-factors for a few baseband filtered PCM/PM settings are shown below (Table 4 and Table 5), which can be used when applicable. Only the PCM/PM without subcarrier is shown since the cases with subcarrier are less common, especially for filtered PCM/PM. When a setting approximately matches one of those listed in the tables below, the corresponding K-factors should be used, otherwise the upper bound limits given by the unfiltered results discussed in the previous section can be utilized. Furthermore, it is recommended to utilize simulation tools when available to estimate the required bandwidth and K-factors for other settings, while noting that filtered values should never exceed the upper bounds provided by the unfiltered cases. The simulation results may vary depending on the included models (example power amplifiers, nonlinearities, input data asymmetry and imbalance, and other nonlinear effects), and hence additional margins can be added accordingly.

The next two tables show the K-factors values for a selective set of filtered PCM/PM. The K-factors are equal to  $BW_{95\%}/R$  where R is the input data rate, which could include all source and channel encoding bits, such as error coding. The tables show results for filtered PCM/PM with NRZ, and Bi-Phi (or Manchester).

**Table 4: K-factors for PCM/PM NRZ with Filtering and without Subcarrier**

<b>Modulation Index (m)</b>	<b>Filter Type</b>	<b>Filter Characteristics</b>	<b>K-factor</b>
1.2	Square Root Raised Cosine	2000 tap; roll off factor=1	2x0.6
1.2	Butterworth	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x1.1
1.2	Bessel	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x1.3
$\pi/2$	Square Root Raised Cosine	2000 tap; roll off factor=1	2x1.0
$\pi/2$	Butterworth	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x2.0
$\pi/2$	Bessel	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x1.8

**Table 5: K-factors for PCM/PM Bi-Phi with Filtering and without Subcarrier**

<b>Modulation Index (m)</b>	<b>Filter Type</b>	<b>Filter Characteristics</b>	<b>K-factor</b>
1.2	Square Root Raised Cosine	2000 tap; roll off factor=1	2x2.0
1.2	Butterworth	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x3.0
1.2	Bessel	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x3.0
$\pi/2$	Square Root Raised Cosine	2000 tap; roll off factor=1	2x2.6
$\pi/2$	Butterworth	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x4.0
$\pi/2$	Bessel	3 pole; Bandwidth Symbol Time Product (BTs)=2	2x4.0

### **J.3.5 DIGITAL FM**

1. Digital FM is generally a form of frequency shift keying (FSK) modulation. For the necessary bandwidth of digital FM systems, a form of Carson's Rule is again used with the first term replaced by its digital equivalent as

follows:<sup>6</sup>

$$B_n = R/\log_2 S + 2KD \quad \text{Reference Eq. J-18}$$

where R is the transmitted RF bit rate and S is the number of equivalent non-redundant signaling states. The value for K depends on the modulation format and specific filtering, but a value of 0.89 to 1.2 is often used based on the theoretical 99% occupied bandwidth. In some cases where the modulation index and filtering are standardized, the  $B_n$  can be expressed simply as:<sup>7</sup>

$$B_n = KR/\log_2 S \quad \text{J-19} \quad \text{or} \quad B_n = KR \quad \text{Reference Eq. J-20}$$

2. Minimum shift keying (MSK), Gaussian-filtered MSK (GMSK), and Continuous Phase FSK (CPFSK) are popular forms of FSK that are defined by a bandwidth·time ( $B_{3dB}T$ ) product.<sup>8</sup> Using equation J.20, Recommendation ITU-R SM.328 defines the K factor for several values of  $B_{3dB}T$  given below based on the theoretical 99% occupied bandwidth.

Modulation	D	$B_{3dB}T$	K
CPFSK (unfiltered)	.35R (typical)	$\infty$	1.62
MSK (unfiltered)	.25R	$\infty$	1.28
GMSK	.25R	1.0	$\approx 1.15$
GMSK	.25R	0.5	1.03
GMSK	.25R	0.3	.91
GMSK	.25R	0.25	.86
GMSK	.25R	0.15	.70

Caution should be exercised to define R as the transmitted RF data rate with all data, overhead, redundancy, and error-correction bits included rather than the data rate available to the end user, which can be significantly lower. Also caution should be used in applying the factor D since often in the literature the modulation index for FSK systems may be stated in terms of the total deviation which is twice the peak deviation (D) used herein. Examples are provided later in Table A.

3. For telegraphy systems using FSK, the information rate is normally expressed in bauds (B) with the necessary bandwidth given by:

$$B_n = B + 2KD \quad \text{Reference Eq. J-21}$$

where K is typically 1.1 to 1.2.<sup>9</sup>

### J.3.6 DIGITAL AMPLITUDE SHIFT KEYING, PHASE SHIFT KEYING, AND QUADRATURE AMPLITUDE MODULATION

1. The necessary bandwidth for Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), and Quadrature Amplitude Modulation (QAM) are all computed in the same manner as:<sup>10</sup>

<sup>6</sup> “Necessary Bandwidth”, Recommendation ITU-R SM.853-1, 1997, Geneva - <http://www.itu.int/pub/R-REC>

<sup>7</sup> “Spectra and Bandwidth of Emissions”, ITU-R SM.328-11, 2006, Geneva - <http://www.itu.int/pub/R-REC>

<sup>8</sup> Where  $B_{3dB}$  is the filter 3 dB bandwidth and T is the symbol length

<sup>9</sup> Determination of necessary bandwidths including examples for their calculation and associated examples for the designation of emissions, Rec. ITU-R SM.1138-2, Geneva, October 2008 - <http://www.itu.int/pub/R-REC>

<sup>10</sup> Recommendation ITU-R SM.853-1, Necessary Bandwidth, 1997 - <http://www.itu.int/pub/R-REC>

$$B_n = 2KR/\text{Log}_2S \quad \text{Reference Eq. J-22}$$

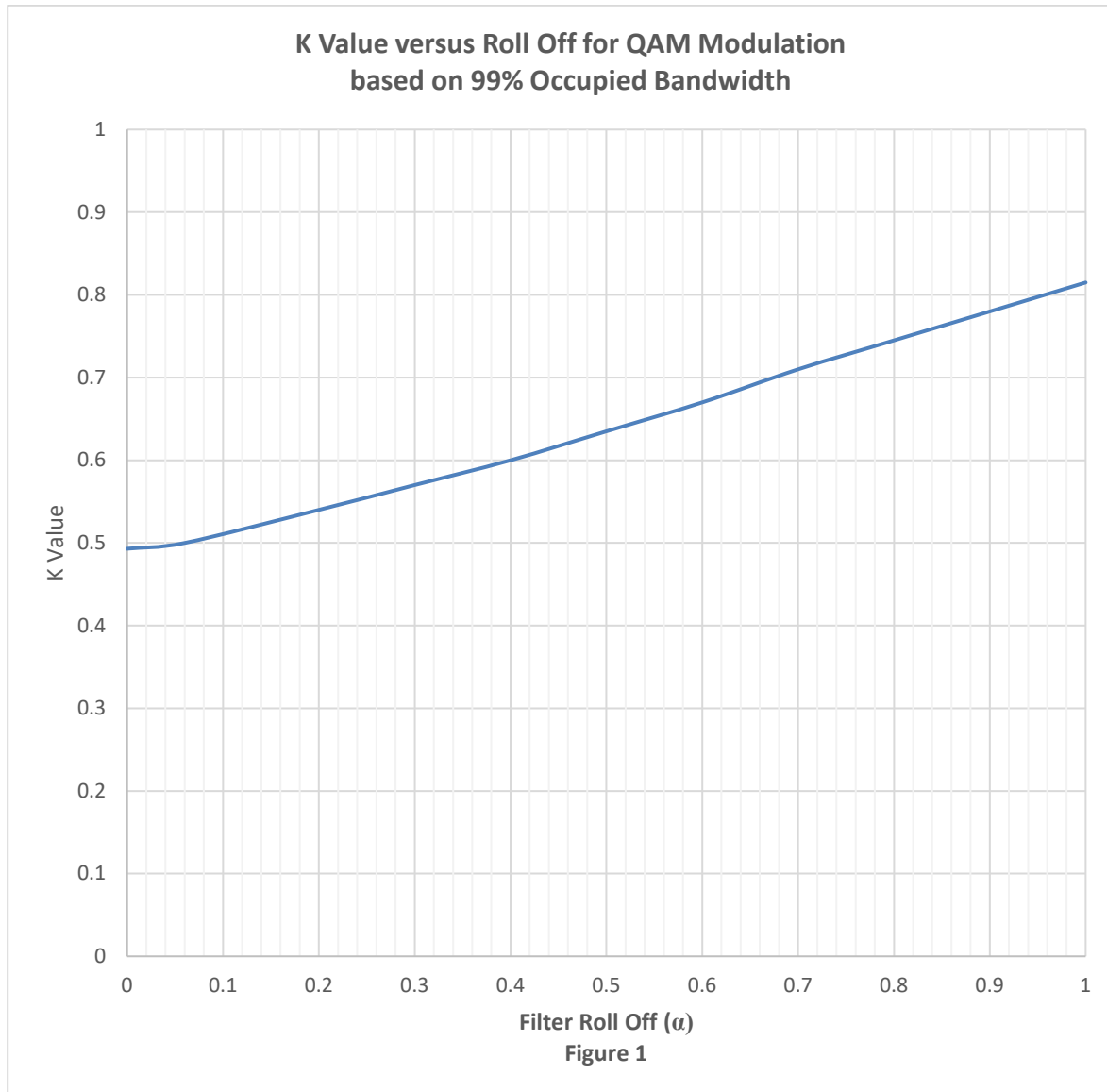
Values for K depend primarily on the nature of the baseband filtering employed in the transmitter. One common form of filtering is root raised cosine (RRC) that is defined by a rolloff factor ( $\alpha$ ) with a value between 0 and 1.

Figure 1, taken from Recommendation ITU-R SM.853, gives computed K values as a function of the rolloff factor for use with Equation J.22 for QAM systems using RRC filtering. Figure 1 may also be a useful guide for ASK and PSK modulation types as well. Note that in the special case where vestigial sideband techniques are used with ASK, PSK, or QAM, the K value could approach  $\frac{1}{2}$  of the value given by Figure 1. In some cases where the modulation index and filtering are standardized, the necessary bandwidth can be expressed simply as:

$$B_n = KR \quad \text{Reference Eq. J-23}$$

As described above, caution should be exercised to define R as the transmitted RF value with all data, overhead, redundancy, and error-correction bits included.

**Figure 1 K Value Versus Roll off for QAM Modulation**



2. For the special case of telegraphy using manual ASK techniques (Morse code), the necessary bandwidth is defined by:

$$B_n = KB \quad \text{Reference Eq. J-24}$$

where K is 5 for fading circuits and 3 for non-fading circuits.

### J.3.7 RADAR SYSTEMS AND PULSE MODULATION

1. Five types of radar systems are in common use: unmodulated continuous wave (CW), frequency modulated CW (FM/CW), unmodulated pulse, phase-coded pulse, and frequency modulated pulse. For federal radar systems, agreed upon methodologies for calculating necessary bandwidth have been established as shown below:

Radar Type	$B_n$	Reference Eq.
CW <sup>11</sup>	0 Hz	J-25
FM/CW	$2B_{\text{FM/CW}}$	J-26
Unmodulated pulsed <sup>12,13</sup>	$\text{MIN} \left\{ \frac{1.79}{\sqrt{t_r t}}, \frac{6.36}{t} \right\}$	J-27
Phase-coded pulsed <sup>12,13, 14</sup>	$\text{MIN} \left\{ \frac{1.79}{\sqrt{t_r t}}, \frac{6.36}{t} \right\}$	J-28
Frequency modulated pulsed <sup>12</sup>	$\left\{ \frac{1.79}{\sqrt{t_r t}} + 2B_c \right\}$	J-29

where  $B_c$  = Bandwidth of the frequency deviation for FM modulated pulsed radars (the total frequency shift during the pulse duration) in MHz.

$B_{\text{FM/CW}}$  = Bandwidth of the frequency deviation (peak difference between instantaneous frequency of the modulated wave and the carrier frequency for FM/CW radar systems).

$t$  = Emitted pulse duration in  $\mu\text{sec}$  at 50% amplitude (voltage) points. The 100% amplitude is the nominal peak level of the pulse.

$t_r$  = Emitted pulse rise time in  $\mu\text{sec}$  from the 10% to the 90% amplitude points on the leading edge.

2. For non-radar pulse systems, a universally accepted methodology has not been identified. For unmodulated pulse systems, Recommendation ITU-R SM.1138 lists:

$$B_n = 2K/t \quad \text{Reference Eq. J-30}$$

But this recommendation states “K depends upon the ratio of pulse duration to pulse rise time. Its value usually falls between 1 and 10 and in many cases it does not need to exceed 6.” For purposes herein, equations J-27 through J-29 may be used for non-radar pulse systems.

### J.3.8 MULTIPLE CARRIER MODULATION

Many modern communication systems employ multiple carrier modulation. These take several forms including orthogonal frequency division multiplex (OFDM), coded OFDM (COFDM) and orthogonal frequency division multiple access (OFDMA). Each of these types use a large number of closely spaced orthogonal subcarriers to carry data with each subcarrier modulated using conventional techniques such as PSK or QAM. For federal multiple carrier

<sup>11</sup> The emission of a CW transmitter will not be zero due to noise and other considerations. However, designating zero as the necessary bandwidth is a valid method for identifying such equipment.

<sup>12</sup> For frequency hopping systems the necessary bandwidth is the instantaneous one of an individual channel.

<sup>13</sup> MIN means the minimum of the two indicated terms.

<sup>14</sup> For phase coded pulse signals the pulse width and rise times are those associated with a single sub-pulse or chip. If the rise time of a single sub-pulse is not available, assume it is 40% of the time to switch from one phase or sub-pulse to the next.

systems with  $N_s > 16$ , the following approximation has been used to calculate necessary bandwidth:

$$B_n = (N_s + 16.25)C_s \quad \text{Reference Eq. J-31}$$

where  $N_s$  is the number of active subcarriers and  $C_s$  is the spacing between subcarriers.<sup>15</sup>

It is noted that many commercial systems using multiple carrier modulation specify the bandwidth as simply:<sup>16</sup>

$$B_n = N_s C_s \quad \text{Reference Eq. J-32}$$

As an exception to the above, some multiple carrier systems, such as hybrid systems discussed below, do not have a contiguous series of carriers in which case equation J-12 may be used.

### J.3.9 SPREAD SPECTRUM MODULATION

Spread spectrum systems can be defined in several ways but normally take the form of either direct sequence spread spectrum (DSSS) or frequency-hopping spread spectrum (FHSS). In both cases the signal is intentionally spread over a much wider bandwidth than the baseband information bandwidth. For DSSS (also called CDMA, see below), binary PSK (BPSK) is typically used as the spreading technique and the necessary bandwidth can be calculated using methods described earlier for PSK. As noted earlier for frequency hopping systems, such as FHSS (also called FHMA, see below), the necessary bandwidth is normally the instantaneous bandwidth of an individual channel. However, it should be noted that the necessary bandwidth of some federal frequency hopping systems has been historically defined using the full hopping bandwidth as:

$$B_n = B_h + B_{ch} \quad \text{Reference Eq. J-33}$$

where  $B_h$  is the total frequency hopping bandwidth and  $B_{ch}$  is the individual channel bandwidth.

### J.3.10 MULTIPLE ACCESS SYSTEMS

Multiple access techniques are not modulation methods per se but are often included as part of the overall modulation description of a system. There are a large number of multiple access methods including: frequency division multiple access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA), orthogonal frequency division multiple access (OFDMA), spatial division multiple access (SDMA), frequency hopping multiple access (FHMA), and carrier sense multiple access (CSMA). The necessary bandwidth for systems using CDMA, OFDMA, and FHMA techniques has been discussed earlier. For systems using TDMA, SDMA, FDMA, or CSMA techniques, the necessary bandwidth is generally calculated based on the modulation used by an individual user using techniques described earlier.

### J.3.11 HYBRID SYSTEMS

In some cases, two signals can be overlaid within the same channel called composite or hybrid modulations. This is the case for the U.S. digital AM and FM commercial broadcast standards known as in-band on-channel (IBOC). IBOC refers to the method of transmitting a digital radio broadcast signal in the same channel as the AM or FM station's analog signal. The transmission of the digital signal using COFDM methods occupies the sidebands above and below the analog signal and transmitted at a lower power level. For these broadcast stations, the composite emission is limited by regulations to the existing analog spectral emission mask and, as a result, the necessary bandwidth is considered to be the same as the original analog signal.

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<sup>15</sup> In some cases, certain subcarriers are not active (do not carry data or pilot tones) to provide guardbands. Only the number of active subcarriers is used in these equations.

<sup>16</sup> Determination of necessary bandwidths including examples for their calculation and associated examples for the designation of emissions, Rec. ITU-R SM.1138-2, Geneva, October 2008 - <http://www.itu.int/pub/R-REC>

### J.3.12 ULTRAWIDEBAND SYSTEMS

Ultrawideband (UWB) systems are authorized under provisions of Sections 7.8, 7.9, 8.3.31, or 10.11 of this Manual. The bandwidth of UWB systems is defined as the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. These systems are typically pulse or impulse modulated but may include other forms. There are no defined methodologies for calculating the UWB necessary bandwidth, which is usually defined by measurements. Section K.3.6 describes emission limitations applicable to these systems.

### J.3.13 OTHER FACTORS

Guardbands are not normally included as part of the necessary bandwidth of a system, although they are occasionally included especially in commercial systems. For example, a 4G-LTE signal specified as 10 MHz typically has an actual necessary bandwidth of 9 MHz. Also since most of the equations described above include certain approximations, it is sometimes misleading or false precision to specify a calculated necessary bandwidth result to three or four significant digits. Consequently, rounding of calculated results to two significant digits or even one significant digit is sometimes used.

## J.4 SYMBOLS

As appropriate, Table A shall be used for calculation of necessary bandwidth. The following symbols are used in this table:

$B_{3dB}$  = 3 dB filter bandwidth

$B$  = Digital symbol rate for telegraphy (i.e. baud)

$B_c$  = Bandwidth of the frequency deviation for FM modulated pulsed radars (the total frequency shift during the pulse duration) in MHz.

$B_{ch}$  = Bandwidth of an individual channel (frequency hopping system)

$B_{FM/CW}$  = Bandwidth of the frequency deviation (peak difference between instantaneous frequency of the modulated wave and the carrier frequency for FM/CW radar systems).

$B_h$  = Total frequency hopping bandwidth

$B_n$  = Necessary bandwidth

$B_{sc}$  = Bandwidth of the highest frequency subcarrier.

$BW_{95\%}$  = The 95% power containment two sided bandwidth

$C_{max}$  = Highest frequency subcarrier or furthest removed from the carrier frequency.

$C_s$  = Separation in frequency between adjacent sub-carriers or carriers of a multi-carrier modulation.

$D$  = Peak deviation, i.e., half the difference between the maximum and minimum values of the instantaneous frequency.

$F_s$  = The frequency (Hz) for a PCM/PM modulation subcarrier

$K$  = An overall numerical factor which varies according to the emission and which depends upon the allowable signal distortion.

$M$  = Maximum modulation frequency

$MI$  = Modulation index

$M_l$  = Lowest modulation frequency

$M_{res}$  = Width of the residual sideband in a vestigial sideband system.

$M_{sum}$  = Sum of the  $M$  for each channel in a multichannel system.

$N_c$  = Number of baseband channels in radio systems employing multichannel multiplexing.

$N_s$  = Number of sub-carriers

$R$  = Total bit rate, which includes data, encoding, and any other overhead bits.

$S$  = Number of equivalent non-redundant signaling states.

- t =       Emitted pulse duration in  $\mu\text{sec}$  at 50% amplitude (voltage) points. The 100% amplitude is the nominal peak level of the pulse.
- $t_f$  =       Emitted pulse fall time in  $\mu\text{sec}$  from the 90% to the 10% amplitude points on the trailing edge.
- $t_r$  =       Emitted pulse rise time in  $\mu\text{sec}$  from the 10% to the 90% amplitude points on the leading edge.

## **J.5       EXAMPLES**

Table A below, provides a list of common modulations used by federal agencies and specific examples of necessary bandwidth calculations for each type. The modulations are ordered by radio service for ease of use. Because of continued expansion of sharing of frequency bands by both federal and non-federal users, some common non-federal examples are included for illustrative purposes. While it is impractical herein to address all modern forms of digital modulation, the expanded list of digital examples includes many common forms.

**TABLE A: Example Necessary Bandwidth Calculations**

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>BROADCASTING SERVICE</b>			
<b>HF Sound Broadcasting</b> Analog AM (DSB)	$B_n = 2M$ J-1/J-6	Single channel voice and music $M = 4.5 \text{ kHz}$ ; $B_n = 9 \text{ kHz}$	9K00A3E
<b>HF Sound Broadcasting</b> Analog AM (SSB-SC)	$B_n = M - M_1$ J-7	Single channel voice and music $M = 4.5 \text{ kHz}$ ; $M_1 = 150 \text{ Hz}$ $B_n = 4.35 \text{ kHz}$	4K35J3E
<b>HF Sound Broadcasting</b> Analog AM (SSB-RC)	$B_n = M$ J-1/J-3	Single channel voice and music $M = 4.5 \text{ kHz}$ ; $B_n = 4.5 \text{ kHz}$	4K50R3E
<b>HF Sound Broadcasting</b> Digital COFDM	$B_n = C_s N_s$ J-32	Digital Radio Mondiale standard BPSK to 64 QAM channel modulation $C_s = 41.66 \text{ Hz}$ ; $N_s = 228$ $B_n = 9.5 \text{ kHz}$	9K50W1E <sup>17</sup>
<b>AM Sound Broadcasting</b> Analog AM (DSB)	$B_n = 2M$ J-1/J-6	Speech and music (U.S. standard) $M = 10 \text{ kHz}$ ; $B_n = 20 \text{ kHz}$	20K0A3E
<b>AM Sound Broadcasting</b> IBOC hybrid analog AM (DSB) plus Digital OFDM (U.S. digital AM broadcast standard)	$B_n = 2M$ (analog) J-1/J-6	Analog speech and music $M = 8 \text{ kHz}$ ; $B_n = 16 \text{ kHz}$	20K0X9W <sup>18</sup>  (hybrid system)
	$B_n = 2C_{\max} + B_{sc}$ (digital) $B_{sc} \approx C_s$ J-12	Digital voice, music & data $C_s = 181.7 \text{ Hz}$ ; $N_s = 50$ ; $C_{\max} = 14.717 \text{ kHz}$ $B_{sc} = 181.7 \text{ Hz}$ $B_n \approx 30 \text{ kHz}$	
<b>FM Sound Broadcasting</b> Analog FM monaural	$B_n = 2M + 2KD$ $K = 1$ (typical) J-15	High fidelity voice & music $M = 15 \text{ kHz}$ ; $D = 75 \text{ kHz}$ $B_n = 180 \text{ kHz}$	180KF3E
<b>FM Sound Broadcasting</b> Analog FM stereophonic with multiplexed subcarriers	$B_n = 2M + 2KD$ $K = 1$ (typical) J-15	High fidelity voice, music & data Composite $M = 100 \text{ kHz}$ ; $D = 75 \text{ kHz}$ $B_n = 350 \text{ kHz}$	240KF9W <sup>19</sup>
<b>FM Sound Broadcasting</b> IBOC hybrid mode analog FM plus digital OFDM (U.S. digital FM broadcast standard)	$B_n = 2M + 2KD$ (Analog) $K = 1$ (typical) J-15	High fidelity voice, music & data Composite $M = 100 \text{ kHz}$ ; $D = 75 \text{ kHz}$ $B_n = 350 \text{ kHz}$	240KF9W <sup>19</sup>  (hybrid system)
	$B_n = 2C_{\max} + B_{sc}$ (Digital) $B_{sc} \approx C_s$ J-12	Digital voice, music & data $C_s = 363.4 \text{ Hz}$ ; $N_s = 382$ ; $C_{\max} = 198.4 \text{ kHz}$ ; $B_{sc} = 363.4 \text{ Hz}$ $B_n \approx 400 \text{ kHz}$	

<sup>17</sup> See 47 CFR 73.758. Other combinations of  $C_s$  and  $N_s$  are also possible.

<sup>18</sup> Compliance with requirements of 47 CFR 73.44 is deemed by the FCC to show the occupied bandwidth to be 20 kHz or less. Other analog and digital parameters also possible. See <http://www.nrsstandards.org/SG/NRSC-5-D.pdf>.

<sup>19</sup> Compliance with requirements of 47 CFR 73.317 is deemed by the FCC to show the occupied bandwidth to be 240 kHz or less. Other analog and digital parameters also possible. See <http://www.nrsstandards.org/SG/NRSC-5-D.pdf>.



Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>Television Broadcasting (Analog)</b> Video AM - VSB Audio FM – stereo plus multiplex subcarriers (U.S. NTSC analog TV standard)	$B_n = M + M_{res}$ (video) J-8 $B_n = 2M + 2KD$ (audio) $K = 1$ (typically) J-15	Standard definition video $M = 4.2$ MHz; $M_{res} = 0.75$ MHz $B_n = 4.95$ MHz (5.75 MHz w/guardbands) Stereo voice and music Composite $M = 120$ kHz; $D = 75$ kHz $B_n = 390$ kHz	5M75C3F 250KF8E <sup>20</sup> combined in a 6 MHz channel
<b>Television Broadcasting (Digital)</b> 8ASK, vestigial sideband (8VSB) Rate 0.6 FEC Filter rolloff = 0.115	$B_n = 2KR/\text{Log}_2S$ $K \approx 0.278$ J-22	U.S. HDTV Standard Multiplexed video, audio, data $R = 32.28$ Mbps (19.39 Mbps to user) $S = 8$ $B_n = 6$ MHz	6M00C7W
FIXED AND MOBILE SERVICES (Telegraphy)			
<b>Manual Telegraphy</b> On-off keying (OOK) of carrier	$B_n = KB$ $K = 5$ (typical) J-24	Manual Morse code <sup>21</sup> $\text{WPM} = 25$ ; $B = 20$ Hz $B_n = 100$ Hz	100HA1A
<b>Manual Telegraphy</b> On-off keying (OOK) of subcarrier	$B_n = 2C_{\text{max}} + KB$ $K = 5$ (typical) J-12/J-24	Manual Morse code $\text{WPM} = 25$ ; $B = 20$ Hz; $C_{\text{max}} = 1$ kHz $B_n = 2.1\text{kHz}$	2K10A2A
<b>Direct Printing Telegraphy</b> <sup>22</sup> FSK on a subcarrier with SSB suppressed carrier	$B_n = B + 2KD$ $K = 1.2$ (typical) J-21	Telegraph data $B = 100$ Hz; $D = 85$ Hz $B_n = 304$ Hz	304HJ2B
<b>Direct Printing Telegraphy</b> Two frequency FSK (2FSK)	$B_n = B + 2KD$ $K = 1.2$ (typical) J-21	Telegraph data $B = 100$ Hz; $D = 85$ Hz $B_n = 304$ Hz	304HF1B
<b>Direct Printing Telegraphy</b> Four-frequency FSK (4FSK) with synchronized duplex channels	$B_n = B + 2KD$ $K = 1.1$ (typical) J-21	Telegraph data $B = 100$ Hz; $D = 600$ Hz $B_n = 1.42$ kHz	1K42F7B
FIXED AND MOBILE SERVICES (Telemetry & Telecommand) <sup>23</sup>			
<b>PCM/FM</b> Filtered non-return to zero pulse code modulation/FM $D = 0.35R$ ; premodulation filter bandwidth = 0.7R	$B_n = 1.16R$ J-20	Single channel data $R = 5$ Mbps; $D = 1.75$ MHz $B_n = 5.8$ MHz	5M80F1D

<sup>20</sup> Compliance with requirements of 47 CFR 73.682 is deemed by the FCC to show the occupied bandwidth to be 250 kHz or less.

<sup>21</sup> For manual telegraphy, the Baud rate is typically 0.8 times the words per minute.

<sup>22</sup> See Recommendation ITU-R M.476-5 - <http://www.itu.int/pub/R-REC>

<sup>23</sup> The necessary bandwidths given here for telemetry and telecommand systems are based on the 99% occupied as defined in Telemetry Standards, IRIG 106-15, Appendix A, July 2015. It is recognized that this IRIG source also defines somewhat wider necessary bandwidth values for purposes of frequency scheduling.

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>QPSK</b> Constant envelop offset QPSK (OQPSK); Feher's patented QPSK (FQPSK-B, FQPSK-JR); shaped offset QPSK (SOQPSK-TG)	$B_n = 0.78R$  J-23	Single channel data $R = 5 \text{ Mbps}$ ; $B_n = 3.9 \text{ MHz}$	3M90G1D
<b>ARTM CPM</b> Advanced range telemetry continuous phase modulation $MI = 4/16$ and $5/16$ on alternating symbols	$B_n = 0.56R$  J-23	Single channel data $R = 5 \text{ Mbps}$ , $S = 4$ $B_n = 2.8 \text{ MHz}$	2M80G1D
<b>FIXED AND MOBILE SERVICES (Telephony)</b>			
<b>Analog AM DSB</b> Single channel voice	$B_n = 2M$ J-1/J-6	Commercial grade voice $M = 3 \text{ kHz}$ $B_n = 6 \text{ kHz}$	6K00A3E
<b>Analog AM ISB</b> Two equal-size DSB voice channels	$B_n = M_{\text{sum}}$ J-9	Commercial grade voice 2 channels; $M = 3 \text{ kHz}$ ; $M_{\text{sum}} = 6 \text{ kHz}$ $B_n = 6 \text{ kHz}$	6K00B8E
<b>Analog AM SSB</b> Full or reduced carrier voice	$B_n = M$ J-1/J-3	Commercial grade voice $M = 3 \text{ kHz}$ $B_n = 3 \text{ kHz}$	3K00H3E
<b>Analog AM ISB</b> Suppressed carrier, two or more channel voice	$B_n = M_{\text{sum}} - M_l$ J-10	Commercial grade voice 2 channels; $M = 3 \text{ kHz}$ ; $M_{\text{sum}} = 6 \text{ kHz}$ $M_l = 250 \text{ Hz}$ $B_n = 5.75 \text{ kHz}$	5K75J8E
<b>Analog AM SSB</b> Suppressed carrier, single channel voice	$B_n = M - M_l$ J-7	Maritime mobile HF voice $M = 2.7 \text{ kHz}$ ; $M_l = 350 \text{ Hz}$ $B_n = 2.35 \text{ kHz}$	2K80J3E <sup>24</sup>
<b>Analog FM</b> Narrowband voice	$B_n = 2M + 2KD$ $K = 1$ (typical) J-15	Commercial grade voice $M = 3 \text{ kHz}$ , $D = 2.5 \text{ kHz}$ $B_n = 11 \text{ kHz}$	11K0F3E
<b>Analog FM</b> Wideband voice	$B_n = 2M + 2KD$ $K = 1$ (typical) J-15	Commercial grade voice $M = 3 \text{ kHz}$ , $D = 5 \text{ kHz}$ $B_n = 16 \text{ kHz}$	16K0F3E
<b>FDM/FM</b> Analog frequency division multiplex/FM radio relay	$B_n = 2M + 2KD$ $K = 1$ (typical) J-15	960 multiplexed voice channels $M = 4028 \text{ kHz}$ ; $D = 4140 \text{ kHz}$ $B_n = 16.4 \text{ MHz}$	16M4F8E

<sup>24</sup> Voice passband and necessary bandwidth defined by Recommendation ITU-R M.1173 - <http://www.itu.int/pub/R-REC>

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>C4FM</b> Compatible four level FSK voice Rate ½ rate FEC (APCO Project 25 Phase 1)	$B_n = R/\text{Log}_2S + 2KD$ $K \approx 0.92$ J-18	Commercial grade voice and/or data $R = 9.6 \text{ kbps}$ $S = 4$ ; $D = 1.8 \text{ kHz}$ $B_n = 8.1 \text{ kHz}$	8K10F1W
<b>CQPSK</b> Quadrature phase shift keying (APCO Project 25 Phase 2)	$B_n = 2KR/\text{Log}_2S$ $K \approx 0.5 \text{ to } 0.8$ (typical, depending on filter roll-off factor) J-22	voice channel $R = 12 \text{ kbps}$ $S = 4$ $B_n = 5.76 \text{ kHz}$	5K76G1E
<b>H-DQPSK</b> Harmonized DQPSK (downlink) RRC filter rolloff = 1 (APCO Project 25 Phase 2)	$B_n = 2KR/\text{Log}_2S$ $K \approx 0.817$ J-22	Commercial grade voice and/or data $R = 12 \text{ kbps}$ ; $S = 4$ ; $B_n = 9.8 \text{ kHz}$	9K80G1W <sup>25</sup>
<b>H-CPM</b> Two slot TDMA (uplink) Harmonized continuous phase modulation – a form of QPSK (APCO Project 25 Phase 2)	$B_n = 2KR/\text{Log}_2S$ $K \approx 0.675$ J-22	Commercial grade voice and/or data $R = 12 \text{ kbps}$ ; $S = 4$ $B_n = 8.1 \text{ kHz}$	8K10G1W <sup>26</sup>
<b>FIXED AND MOBILE SERVICES (Video Links)</b>			
<b>Analog FM Video</b> Single channel wideband video	$B_n = 2M + 2KD$ $K = 1$ (typical) J-15	Standard definition video $M = 4.2 \text{ MHz}$ ; $D = 4 \text{ MHz}$ ; $B_n = 16.4 \text{ MHz}$	16M4F3C
<b>Analog FM Video</b> Single channel reduced bandwidth video	$B_n = 2M + 2KD$ $K = 1$ (typical) J-15	Standard definition video $M = 4.2 \text{ MHz}$ ; $D = 1.7 \text{ MHz}$ ; $B_n = 12 \text{ MHz}$	12M0F3C
<b>Digital Video Link</b> GMSK modulation with H.264 video compression; ½ Rate FEC $D = 0.25R$ ; Filter bandwidth = $R$	$B_n = KR/\text{Log}_2S$ $K \approx 1.2$ J-20	Digital Data Link (Video Mode) $R = 11 \text{ Mbps}$ (5.5 Mbps to user); $S = 2$ $B_n = 13.2 \text{ MHz}$	13M2F1F
<b>FIXED AND MOBILE SERVICES (Data)<sup>27</sup></b>			
<b>Binary FSK (BFSK or 2FSK)</b> $0.5R \leq D \leq 10R$	$B_n = R/\text{Log}_2S + 2KD$ $K = 1.2$ (typical) J-18	Single channel data $R = 1 \text{ Mbps}$ ; $D = 750 \text{ kHz}$ ; $S = 2$ $B_n = 2.8 \text{ MHz}$	2M80F1D
<b>Multilevel FSK (MFSK)</b>	$B_n = R/\text{Log}_2S + 2KD$ $K = 0.89$ (typical) J-18	4 level FSK $R = 10 \text{ Mbps}$ ; $D = 2 \text{ MHz}$ ; $S = 4$ $B_n = 8.56 \text{ MHz}$	8M56F1D

<sup>25</sup> In some references, this emission designator is referred to as 9K80F1E or 9K80D7W.

<sup>26</sup> In some references, this emission designator is referred to as 8K10F9W or 8K10DXW

<sup>27</sup> All data rates shown are gross RF data rate including all data, overhead, redundancy, and error-correction bits

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>CPFSK</b> Coherent phase FSK Unfiltered $D = 0.35R$	$B_n = KR$ $K = 1.63$ (typical) J-20	2 level coherent phase FSK $R = 5$ Mbps $B_n = 8.15$ MHz	8M15F1D
<b>MSK</b> Minimum shift keying unfiltered $D = 0.25R$	$B_n = KR$ $K = 1.28$ J-20	2 level coherent phase FSK $R = 2$ Mbps; $B_n = 2.56$ MHz	2M56F1D
<b>GMSK</b> Gaussian MSK $D = 0.25R$ Filter $B_{3dB}T = 0.5$	$B_n = KR$ $K = 1.03$ J-20	2 level Gaussian coherent phase FSK $R = 10$ Mbps; $B_n = 10.3$ MHz	10M3F1D
<b>GMSK</b> Gaussian MSK $D = 0.25R$ Filter $B_{3dB}T = 0.25$	$B_n = KR$ $K = 0.86$ J-20	Maritime Automatic Identification System (AIS) $R = 9.6$ kbps; $B_n = 8.3$ kHz	8K30F1D
<b>GMSK</b> Gaussian MSK $D = 0.25R$ Filter $B_{3dB}T = 0.5$ Frequency hopping	$B_n = KR + B_h$ $K = 1.03$ J-20/J-33	Bluetooth (IEEE 802.15.1 v1.2) $B_h = 79$ MHz; $R = 1$ Mbps; $B_n \approx 80$ MHz	80M0F1D
<b>PSK</b> <sup>28</sup> Binary phase shift keying (BPSK) Unfiltered	$B_n = 2KR/\log_2 S$ $K \approx 1$ (for 95% occupied bandwidth) J-22	Data $R = 10$ Mbps; $S = 2$ $B_n = 20$ MHz	20M0G1D
<b>M-PSK</b> M-ary phase shift keying Symbol $M=2^n$ , $n=1,2,3,\dots$	$B_n = 2KR/\log_2 S$ $K \approx 0.6$ to $0.8$ (typical, depending on filter roll-off factor) J-22	4 PSK $R = 10$ Mbps; $S = 4$ ; $k = 0.7$ $B_n = 7.0$ MHz	7M00G1D
<b>BPSK TDMA</b> Fixed frequency Mode	$B_n = 2KR/\log_2 S$ $K \approx 0.9$ J-22	DoD Link 16 $t = 6.4$ us; $R = 5$ Mbps; $S = 2$ $B_n = 9.0$ MHz	9M00Q1D
<b>BPSK TDMA</b> Frequency hopping Mode	$B_n = 2KR/\log_2 S + B_h$ $K \approx 0.9$ J-22/J-33	DoD Link 16 $t = 6.4$ us; $R = 5$ Mbps; $S = 2$ $B_h = 237$ MHz $B_n = 246$ MHz	237MQ1D <sup>29</sup>
<b>M-QAM</b> Quadrature amplitude modulation $M=2^n$ , $n = 1,2,3,\dots$	$B_n = 2KR/\log_2 S$ $K \approx 0.6$ to $0.8$ (typical, depending on filter roll-off factor) J-22	64QAM $R = 135$ Mbps, $S = 64$ , $K = 0.65$ $B_n = 29.3$ MHz	29M3D1D

<sup>28</sup> Included for illustrative purposes only; all practical systems employ some form of baseband filtering.

<sup>29</sup> The Link 16 necessary bandwidth in the frequency hopping mode has historically been stated in terms of the total hopping bandwidth.

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>M-Trellis-Coded Modulation</b> $M=2^n$ , $n = 1,2,3 \dots$	$B_n = 2KR/\text{Log}_2 S$ $K \approx 0.6$ to $0.8$ (typical, depending on filter roll-off factor) J-22	128TCM $R = 155.5$ Mbps, $K = 0.65$ $S = 128$ $B_n = 28.9$ MHz	28M9D7W
<b>Multicarrier Modulation</b> Orthogonal frequency division multiplexing (OFDM) Federal system	$B_n = (N_s + 16.25)C_s$ $N_s > 16$ J-31	Data $N_s = 48$ active subcarriers; $C_s = 250$ kHz 16 QAM channel modulation $B_n = 16.1$ MHz	16M1D1D
<b>Multicarrier Modulation</b> OFDM (20 MHz channel) Voice, data, video Commercial system	$B_n = N_s C_s$ J-32	WiFi (IEEE 802.11ac standard) $N_s = 56$ active subcarriers; $C_s = 312.5$ kHz BPSK through 256QAM carrier modulation $B_n = 17.5$ MHz	17M5D7W
<b>Multicarrier Modulation</b> OFDM voice, data, video Commercial system	$B_n = N_s C_s$ J-32	4G-LTE downlink (3GPP Release 10) BPSK through 64QAM mod.; $C_s = 15$ kHz 10 MHz chan. $N_s = 600$ $B_n = 9.0$ MHz	9M00D7W
<b>RADIODETERMINATION AND METEOROLOGICAL AID SERVICES<sup>30</sup></b>			
<b>CW Radar<sup>31</sup></b>	$B_n = 0$ J-25	CW Doppler radar	0H00N0N
<b>FM/CW Radar</b>	$B_n = 2B_{\text{FM/CW}}$ J-26	Linear swept FM $B_{\text{FM/CW}} = 100$ MHz; $B_n = 200$ MHz	200MF3N
<b>Unmodulated Pulse Radar</b>	$B_n = \text{Min} [1.79/\text{SQRT}(t_r t_f), 6.36/t]$ J-27	Non-trapezoidal shaped pulses <sup>32</sup> $t = 1$ usec; $t_r = 0.2$ usec; $t_f = 0.15$ usec $B_n = 4.62$ MHz	4M62P0N

<sup>30</sup> Certain navigation system parameters were drawn from “Spectrum Management Regulations and Procedures Manual,” Federal Aviation Administration, 17 Nov 2005

<sup>31</sup> The emission of a CW transmitter will not be zero due to noise and other considerations. However, designating zero as the necessary bandwidth is a valid method for identifying such equipment.

<sup>32</sup> For non-trapezoidal shaped pulses, use the smaller of  $t_r$  and  $t_f$  in the equation in place of  $t_r$

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
FM Chirp Pulse Radar	$B_n = \frac{1.79}{\sqrt{t_r * t}} + 2B_c$ <p>Starting on January 1, 2020, when the following conditions are met (for linear and non-linear chirps),</p> <p>is:</p> $B_n = 1.44 * \left[ B_c + \ln(B_c * t)^{0.35} * \frac{\min(B_{Rise}, B_{Fall}, B_{Rise\_Fall}) + \frac{\max(B_{Rise}, B_{Fall}, B_{Rise\_Fall})}{(B_c * t)^{1.5}}}{(B_c * t)^{1.5}} \right]$ <p>Where:</p> $B_{Rise} = \frac{1}{\sqrt{t_r * t}}$ $B_{Fall} = \frac{1}{\sqrt{t_f * t}}$ $B_{Rise\_Fall} = \frac{1}{\sqrt[3]{t * t_r * t_f}}$ <p>Else</p> $B_n = \frac{1.79}{\sqrt{t_r * t}} + 2B_c$ <p>J-29</p>	<p>Trapezoidal shaped pulses</p> <p>t = 25 usec; t<sub>r</sub> = 0.15 usec; t<sub>f</sub> = 0.15 usec</p> <p>B<sub>c</sub> = 3 MHz      B<sub>n</sub> = 6.92MHz</p>	6M92Q3N
Phase-coded Pulse Radar	<p>B<sub>n</sub> = Min [1.79/SQRT(t<sub>t</sub>), 6.36/t]</p> <p>J-28</p>	<p>Trapezoidal shaped pulses</p> <p>chip t = 0.5 usec; chip t<sub>r</sub> = 0.02 usec;</p> <p>chip t<sub>f</sub> = 0.02 usec      B<sub>c</sub> = 12.7 MHz</p>	12M7Q1N

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>VHF Omnidirectional Range (VOR)</b> Analog DSB AM with subcarriers	$B_n = 2C_{\max} + 2M + 2KD$ $K = 1$ (Typical)  J-14	Carrier DSB modulated by: 1) 30 Hz subcarrier 2) 9960 Hz subcarrier with 30 Hz FM tone; D = 480 Hz 3) 3 kHz voice channel 4) keyed 1020 Hz subcarrier $C_{\max} = 9960$ Hz; $M = 30$ Hz; $D = 480$ Hz $B_n = 20.9$ kHz	20K90A2A (without voice) 20K9A9W (voice)
<b>Marker Beacon</b> AM-DSB Tone modulated	$B_n = 2C_{\max}$  J-13	Carrier modulated by: <sup>33</sup> 400 Hz tone (Outer marker) $B_n = 800$ Hz 1.3 kHz tone (Mid marker) $B_n = 2.6$ kHz 3 kHz tone (Inner marker) $B_n = 6$ kHz	800HA2A 2K60A2A 6K00A2A
<b>DME</b> Distance Measuring Equipment Interrogator & transponder	$B_n = \text{Min} [1.79/\text{SQRT}(t_r t), 6.36/t]$ J-27	Sequence of position modulated pulses $t = 3.5$ us; $t_r = 2.5$ us; $t_f = 2.5$ us $B_n = 605$ kHz (typ. rounded to 650 kHz)	650K00M1A 605K00M1A
<b>TACAN</b> Tactical Air Navigation System	$B_n = \text{Min} [1.79/\text{SQRT}(t_r t), 6.36/t]$ J-27	Sequence of position modulated pulses $t = 3.5$ us; $t_r = 2.5$ us; $t_f = 2.5$ us $B_n = 605$ kHz (typ. rounded to 650 kHz)	650K00V1A
<b>IFF</b> Identification Friend or Foe Transponder Pulse position modulation	$B_n = \text{Min} [1.79/\text{SQRT}(t_r t), 6.36/t]$ J-27	IFF Mode 4 response Sequence of position modulated pulses $t \approx .5$ us; $t_r = .065$ us; $t_f = .08$ us $B_n \approx 10$ MHz	10M0M1D
<b>ATCRBS</b> Air Traffic Control Radar Beacon System Interrogator	$B_n = \text{Min} [1.79/\text{SQRT}(t_r t), 6.36/t]$ J-27	Sequence of position modulated pulses $t = 0.8$ us; $t_r = 0.05$ to $0.1$ us; $t_f = 0.05$ to $0.2$ us $B_n \approx 6.3$ MHz (typ. rounded to 6 MHz)	6M00M1D
<b>Mode S</b> Interrogator	$B_n = \text{Min} [1.79/\text{SQRT}(t_r t), 6.36/t]$ J-28	Sequence of position modulated pulses some of which are biphasic modulated chip $t = 0.25$ us; chip $t_r \approx 0.028$ us $B_n \approx 21.5$ MHz	21M5V1D
<b>ILS Localizer</b> Instrument Landing System AM-DSB	$B_n = 2C_{\max}$  J-13	Carrier modulated by: <sup>30</sup> 1. 90 Hz tone 2. 150 Hz tone 3. 1020 Hz tone $B_n = 2.04$ kHz	2K04A1A 10K04A9W 8K00A9W

<sup>33</sup> Although one or more tones may periodically be modulated with low speed Morse code identification or other low speed data, it is considered inconsequential to the overall bandwidth.

Type of Service/ Description of Emission	Formula/ Reference Equation	Type of Signal/ Sample Calculation	Emission Designator
<b>GBAS</b> Ground Based Augmentation System	[TBD]	Phase modulated by two or more channel transmitting data.  $B_n \approx 14 \text{ kHz}$	14K00G7D
<b>GBTS</b> Ground Based Transceiver Service	[TBD]	Frequency modulated by single channel transmitting data  $B_n \approx 1.73 \text{ MHz}$ $B_n \approx 1.30 \text{ MHz}$	1M73F1D (978MHz)  1M30F1D (1090 MHz)
<b>Glide Slope</b>	[TBD]	Single channel with Amplitude modulated Double-sideband  $B_n \approx 8.30 \text{ kHz}$ $B_n \approx 300 \text{ Hz}$	8K30A1N (Capture effect & Endfire)  300H00A1N (normal/traditional GS)
<b>Non-directional beacon (NDB)</b> AM-DSB tone modulated	$B_n = 2C_{\max}$ J-13	Carrier modulated by a 1.02 kHz tone <sup>30</sup> $B_n = 2.04 \text{ kHz}$ $B_n = 6.00 \text{ kHz}$	2K04A2A (single carrier)  6K00A3E (w/voice and weather information)
<b>SPACE SERVICES</b>			
<b>CW</b>	$B_n = 0$ J-25	Unmodulated downlink satellite beacon	N0N
<b>Tone modulated CW</b>	$B_n = 2 \cdot M$ J-1/J-6	Tone modulated satellite beacon $M = 1 \text{ MHz}$	2M00A3N
<b>GPS</b> Global Positioning System DSSS with BPSK spreading	$B_n = 2KR/\log_2 S$ $K \approx 1.17$ J-22	$R = 10.23 \text{ Mbps}$ ; $S = 2$ $B_n = 24 \text{ MHz}$	24M0G1D
<b>QPSK</b>	$B_n = 2KR/\log_2 S$ $K \approx 0.6$ to $0.8$ (typical, depending on filter roll-off factor)	Data Link $R = 312 \text{ kbps}$ ; $S = 4$ ; $k = 0.65$ $B_n = 203 \text{ kHz}$	203KG1D

(Last Page in Annex J)



# Annex K

## Technical Standards for Federal "Non-Licensed" Devices

### K.1 INTRODUCTION

1. This Annex sets out the Federal Government regulations and technical specifications under which a low power intentional, unintentional or incidental radiator or device may be developed and operated officially by a Federal Government Agency without an NTIA approved frequency assignment as described in Section 7.9 of this Manual. Non-Federal operations of these radiators, called non-licensed devices or Part 15 devices, are regulated by the Federal Communications Commission (FCC) Code of Federal Government Regulations, Title 47, Part 15. FCC regulations and standards do not apply to the Federal Government although many low power devices are operated by the Agencies without an NTIA approved frequency assignment. The NTIA thus provides the regulations and standards in this Annex for regulating Federal Government official development of low power radiators as non-licensed devices. The regulations and standards in this Annex are a subset of the FCC Part 15 regulations. The IRAC/TSC will continue to maintain an awareness of FCC changes to the Part 15 rules and, where appropriate, incorporate such changes in this Annex.

2. A "Cross Reference" of the regulations in this Annex and those in the FCC CFR 47, Part 15 regulations is given at the end of this Annex.

#### K.1.1 Definitions

**Auditory Assistance Device:** An intentional radiator used to provide auditory assistance to a handicapped person or persons. Such a device may be used for auricular training in an educational institution, for auditory assistance at places of public gatherings, such as a church, theater, or auditorium, and for auditory assistance to handicapped individuals, only, in other locations.

**Biomedical Telemetry Device:** An intentional radiator used to transmit measurements of either human or animal biomedical phenomena to a receiver.

**Carrier Current System:** A system that transmits radio frequency energy by conduction over the electric power lines. A carrier current system can be designed such that the signals are received by conduction directly from connection to the electric power lines (unintentional radiator) or the signals are received over-the-air due to radiation of the radio frequency signals from the electric power lines (intentional radiator).

**Class A Digital Device:** A digital device that is for use in a commercial, industrial or business environment, exclusive of a device which is for use by the general public or is intended to be used in the home.

**Class B Digital Device:** A digital device that is for use in a residential environment notwithstanding use in commercial, business or industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

NOTE: The responsible party may also qualify a device intended to be in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

**Cordless Telephone System:** A system consisting of two transceivers, one a base station that connects to the public switched telephone network and the other a mobile handset unit that communicates directly with the base station. Transmissions from the mobile unit are received by the base station and then placed on the public switched telephone network. Information received from the switched telephone network is transmitted by the base station to the mobile unit.

NOTE: The Domestic Public Cellular Radio Telecommunications Service is considered to be part of the switched telephone network. In addition, intercom and paging operations are permitted provided these are not intended to be the primary modes of operation.

**Digital Device (previously defined as a computing device):** An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9,000 pulses (cycles) per second and uses digital

techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates and uses radio frequency energy for the purpose of performing data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. A radio frequency device that is specifically subject to an emanation requirement in any other part or section of the NTIA Manual or an intentional radiator subject to Section K.3 of this Annex that contains a digital device is not subject to the standards for digital devices, provided the digital device is used only to enable operation of the radio frequency device and the digital device does not control additional functions or capabilities.

NOTE: Computer terminals and peripherals that are intended to be connected to a computer are digital devices.

**External Radio Frequency Power Amplifier:** A device which is not an integral part of an intentional radiator as manufactured and which, when used in conjunction with an intentional radiator as a signal source, is capable of amplifying that signal.

**Direct Sequence Systems:** A spread spectrum system in which the carrier has been modulated by a high speed spreading code and an information data stream. The high speed code sequence dominates the "modulation function" and is the direct cause of the wide spreading of the transmitted signal.

**Field Disturbance Sensor:** A device that establishes a radio frequency field in its vicinity and detects changes in that field resulting from the movement of persons or objects within its range.

**Frequency Hopping Systems:** A spread spectrum system in which the carrier is modulated with the coded information in a conventional manner causing a conventional spreading of the RF energy about the frequency carrier. The Frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. The wide RF bandwidth needed by such a system is not required by spreading of the RF energy about the carrier but rather to accommodate the range of frequencies to which the carrier frequency can hop. A frequency hopping system should select operating frequencies from among those in the hop set such that all frequencies are used with equal probability, and all frequency transitions are equally probable.

**Hop Set:** The set of all frequencies upon which a frequency hopping transmitter may operate.

**Incidental Radiator:** A device that generates radio frequency energy during the course of its operation although the device is not intentionally designed to generate or emit radio frequency energy. Examples of incidental radiators are DC motors, mechanical light switches, etc.

**Intentional Radiator:** A device that intentionally generates and emits radio frequency energy by radiation or induction.

**Perimeter Protection System:** A field disturbance sensor that employs RF transmission lines as the radiating source. These RF transmission line are installed in such a manner that allows the system to detect movement within the protected area.

**Unintentional Radiator:** A device that intentionally generates radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

**Ultrawideband system/device:** A system or device or field disturbance sensor that intentionally radiates over a bandwidth of not less than 500 MHz as further described under Section K.3.6 of this Annex.

## K.1.2 Incidental Radiators<sup>1</sup>

1. Manufacturers of these devices shall employ good engineering practices to minimize the risk of harmful interference.

2. An intentional or unintentional radiator shall be constructed in accordance with good engineering design and manufacturing practice. Emanations from the device shall be suppressed as much as practicable, but in no case shall the emanations exceed the levels specified in these rules.

3. An intentional or unintentional radiator must be constructed such that the adjustments of any control that is readily accessible by or intended to be accessible to the user will not cause operation of the device in violation of the regulations.

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<sup>1</sup> This section includes text from CFR 47 Parts 13 and 15.

### **K.1.3 Susceptibility to Interference**

Agencies responsible for equipment compliance are advised to consider the proximity and the high power of non-Federal licensed radio stations, such as broadcast, amateur, land mobile, and non-geostationary mobile satellite feeder link earth stations, and of U.S. Government radio stations, which could include high-powered radar systems, when choosing operating frequencies during the design and acquisition of their equipment so as to reduce the susceptibility for receiving harmful interference.

### **K.1.4 Labeling Requirements**

1. Federal agencies should insure that non-licensed devices purchased under the provisions of Section 7.8 of this manual have the appropriate FCC label affixed.
2. Federal agencies should insure that non-licensed devices developed under the provisions of Section 7.9 and Annex K should have a reference to Section 7.9 and Annex K in the appropriate training and/or operations manual or other documentation.

### **K.1.5 Emission Limits**

The conducted and radiated emission limits shown in this part are based on the following, unless otherwise specified:

a. On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

NOTE: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

b. On any frequency or frequencies above 1000 MHz, the radiated limits shown are based on the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated. Measurements of AC power line conducted emissions are performed using a CISPR quasi-peak detector, even for devices for which average radiated emission measurements are specified.

c. When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measured field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in those cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

### **K.1.6 Frequency Range and Distance Extrapolation of Radiated Measurements**

1. Unless otherwise noted in the specific section in this Annex under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
  - a. If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental

frequency or to 40 GHz, whichever is lower.

b. If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

c. If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

d. If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1)-(a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

2. For unintentional radiators:

a. Except as otherwise indicated in paragraphs (b)(2) or (b)(3), for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

<b>Highest frequency generated or Upper frequency of measurement used in the device or on which the range (MHz) device operates or tunes (MHz)</b>	
Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

b. A unintentional radiator, excluding a digital device, in which the highest frequency generated in the device, the highest frequency used in the device and the highest frequency on which the device operates or tunes are less than 30 MHz and which, in accordance with Section K.2.2 of this Annex, is required to comply with standards on the level of radiated emissions within the frequency range 9 kHz to 30 MHz, such as a CB receiver or a device designed to conduct its radio frequency emissions via connecting wires or cables, e.g., a carrier current system not intended to radiate, shall be investigated from the lowest radio frequency generated or used in the device, without going below 9 kHz (25 MHz for CB receivers), up to the frequency shown in the following table. If the unintentional radiator contains a digital device, the upper frequency to be investigated shall be that shown in the table below or in the table in paragraph (b)(1) above, as based on both the highest frequency generated and the highest frequency used in the digital device, whichever range is higher.

<b>Highest frequency generated or Upper frequency of measurement used in the device or on which the range (MHz) device operates or tunes (MHz)</b>	
Below 1.705	30
1.705 - 10	400
10 - 30	500

c. Except for a CB receiver, a receiver employing superheterodyne techniques shall be investigated from 30 MHz up to at least the second harmonic of the highest local oscillator frequency generated in the device. If such receiver is controlled by a digital device, the frequency range shall be investigated up to the higher of the second harmonic of the highest local oscillator frequency generated in the device or the upper frequency of the measurement range specified for the digital device in paragraph (b)(1) of this section.

3. The above specified frequency ranges of measurements apply to the measurement of radiated emissions and, in the case of receivers, the measurement to demonstrate compliance with the antenna conduction limits specified in Sections K.2.2 and K.3.3 of this Annex. The frequency range of measurements for AC power line conducted limits is specified in Sections K.2.1 and K.3.3 of this Annex and applies to all equipment subject to those regulations. In some cases, depending on the frequency(ies) generated and used by the equipment, only signals conducted onto the AC power lines are required to be measured.

4. Particular attention should be paid to harmonics and subharmonics of the fundamental frequency as well as to those frequencies removed from the fundamental by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

5. To the extent practicable, the device authorized under this annex shall be measured at the distance specified

in the appropriate section of this annex. The distance specified corresponds to the horizontal distance between the measurement antenna and the closest point of the equipment under test, support equipment or interconnecting cables as determined by the boundary defined by an imaginary straight line periphery describing a simple geometric configuration enclosing the system containing the equipment under test. The equipment under test, support equipment and any interconnecting cables shall be included within this boundary.

a. At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

b. At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

c. The extrapolation method used in the device certification will be specified.

d. When measurement distances of 30 meters or less are specified, the equipment will be measured at the distance specified unless measurement at that distance results in measurements being performed in the near field. When measurement distances of greater than 30 meters are specified in the regulations, the equipment can be tested at a closer distance, usually 30 meters, extrapolating the measured field strength to the specified distance using the methods shown in this section.

## **K.2 UNINTENTIONAL RADIATORS**

### **K.2.1 Conducted Limits**

1. Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

2. For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (microvolts)
0.450-1.705	1000
1.705-30.0	3000

3. For carrier current systems used as unintentional radiators whose emissions are contained within the frequency range 450 kHz to 30 MHz, the provisions of this part shall not apply. Such systems are subject to radiated emission limits as provided in Section K.2.2 of this Annex.

4. Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of AC adaptors or battery eliminators or that connect to the AC power line indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

## **K.2.2 Radiated Emission Limits**

1. Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

2. The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of Emission (MHz)	Field Strength (microvolts/meter)
30-88	90
88-216	150
216-960	210
Above 960	300

3. In the emission tables above, the tighter limit applies at the band edges. Section K.1.5 of this Annex specifies the frequency range over which radiated emissions are to be measured.

## **K.3 INTENTIONAL RADIATORS**

### **K.3.1 Antenna Requirements**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible agency shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this part. The agency may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections K.3.5.2, K.3.5.3, or K.3.5.4 of this Annex.

#### **K.3.1.1 External Radio Frequency Power Amplifiers and Antenna Modifications**

1. Except as otherwise described in paragraph two of this section no Federal agency shall use or lease any external radio frequency power amplifier or amplifier kit intended for use with a Part 15 intentional radiator.

2. A transmission system consisting of an intentional radiator, an external radio frequency power amplifier, and an antenna, may be authorized for use under this section. However, when a transmission system is authorized as a system, it must always be used as a complete system and must always be used in the configuration in which it was authorized. An external radio frequency power amplifier shall be used only in the system configuration with which the amplifier is authorized and shall not be used as a separate product.

3. Only the antenna with which an intentional radiator is authorized may be used with the intentional radiator.

### **K.3.2 Restricted Bands of Operation**

1. Except as specified in paragraph 5 of this section, only spurious emissions are permitted in any of the frequency bands listed below:

<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>GHz</b>
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

2. The table below identifies how each of the restricted bands, as identified above, are used.

<b>Restricted Bands by Use</b>	
<b>Band (MHz)</b>	<b>Allocation/Use</b>
0.090-0.110	Loran C radionavigation
0.495-0.505	Maritime distress frequency
2.1735-2.1905	Mobile distress frequency
4.125-4.128	Global Maritime Distress and Safety System
4.17725-4.17775	Global Maritime Distress and Safety System
4.20725-4.20775	Global Maritime Distress and Safety System
6.215-6.218	Global Maritime Distress and Safety System
6.26775-6.26825	Global Maritime Distress and Safety System
6.31175-6.31225	Global Maritime Distress and Safety System
8.291-8.294	Global Maritime Distress and Safety System
8.362-8.366	Maritime & aeronautical survival craft search and rescue
8.37625-8.38675	Global Maritime Distress and Safety System
8.41425-8.41475	Global Maritime Distress and Safety System
12.29-12.293	Global Maritime Distress and Safety System
12.51975-12.52025	Global Maritime Distress and Safety System
12.57675-12.57725	Global Maritime Distress and Safety System
13.36-13.41	Radio astronomy
16.42-16.423	Global Maritime Distress and Safety System
16.69475-16.69525	Global Maritime Distress and Safety System
16.80425-16.80475	Global Maritime Distress and Safety System
25.5-25.67	Radio astronomy
37.5-38.25	Radio astronomy
73-75.2	73-74.6 MHz: radio astronomy, 74.8-75.2 MHz: aeronautical radionavigation marker beacon (75 MHz) and guard bands
108-121.94	108-117.975 MHz: aeronautical radionavigation (aircraft-to-tower), 117.975-121.9375 MHz: aeronautical mobile for safety and regularity of flight, 121.4-121.6 MHz: search and rescue (SARSAT)
123-138	123-123.2 MHz: coordinated search and rescue by mobile, land and aeronautical, 123.2-123.8 MHz: aeronautical flight test voice communications, 123.5875-137 MHz: aeronautical mobile for safety and regularity of flight 137-138 MHz: satellite down link
149.9-150.05	Radionavigation satellite down link
156.52475-156.52525	Global Maritime Distress and Safety System
156.7-156.9	Search and rescue (maritime mobile distress and calling on 156.7625-156.8375 MHz)
162.0125-167.17	Wind shear detection around airports and to warn pilots when emergency action is needed,
167.72-173.2	protection of national and visiting foreign dignitaries, and tracking of endangered and dangerous wildlife, law enforcement

### Restricted Bands by Use

<b>Band (MHz)</b>	<b>Allocation/Use</b>
240-285	243 MHz (SARSAT), satellite down links, military satellites, glide slope indicators, instrument landing systems
322-335.4	322-328.6 MHz: radio astronomy, 328.6-335.4 MHz: aeronautical radionavigation-instrument landing systems
399.9-410	399.9-400.05 MHz: radionavigation satellite, 400.05-400.15 MHz: standard frequency and time signal, 400.15-402 MHz: satellite down links, 402-406 MHz: meteorological aids (radiosondes), 406-406.1 MHz: emergency position-indicating radiobeacon (EPIRB), 406.1-410 MHz: radio astronomy
608-614	Radio astronomy
960-1240	960-1215 MHz: aeronautical radionavigation, 1215-1240 MHz: satellite down link
1300-1427	1300-1350 MHz: aeronautical radionavigation, 1350-1400 MHz: spectral line observation of neutral hydrogen, 1400-1427 MHz: radio astronomy
1435-1626.5	1435-1525 MHz: aeronautical flight test telemetry, 1525-1559 MHz: satellite down links, 1559-1610 MHz: radionavigation satellite down link (GPS) and aeronautical radionavigation, 1610-1626.5 MHz: aeronautical radionavigation, 1610.6-1613.8 MHz: spectral line observation
1645.5-1646.5	Global Maritime Distress and Safety System
1660-1710	1660-1668.4 MHz: radio astronomy, 1668.4-1670 MHz: radio astronomy and radiosonde, 1670-1710 MHz: satellite down link and radiosonde
1718.8-1722.2	Radio astronomy
2200-2300	Satellite down link
2310-2390	Aeronautical flight test telemetry
2483.5-2500	Radiodetermination satellite down link (Geostar)
2655-2900	2655-2690 MHz: radio astronomy and satellite down link, 2690-2700 MHz: radio astronomy, 2700-2900 MHz: air traffic control radars
3260-3267	Spectral line observations (radio astronomy)
3332-3339	Spectral line observations (radio astronomy)
3345.8-3358	Spectral line observation (radio astronomy)
3600-4400	3600-4200 MHz: satellite down link, 4200-4400 MHz: aeronautical radionavigation
4500-5150	4500-4800 MHz: satellite down link, 4800-5000 MHz: radio astronomy, 5000-5150 MHz: aeronautical radionavigation
5350-5460	Aeronautical radionavigation
7250-7750	Satellite down link
8025-8500	Satellite down link
9000-9200	Aeronautical radionavigation
9300-9500	Radar transponders for maritime search and rescue, airborne weather and ground mapping radar for airborne radionavigation
10600-12700	10600-10700 MHz: radio astronomy, 10700-12200 MHz: satellite down link, 12200-12700 MHz: direct broadcast satellite
13250-13400	Aeronautical radionavigation
14470-14500	Spectral line observation (radio astronomy)
15350-16200	15350-15400 MHz: radio astronomy, 15400-15700 MHz: shuttle landing system, airborne weather and ground mapping radar for radionavigation, 15700-16200 MHz: airport surface detection equipment used to locate and navigate aircraft while on the ground
17700-21400	Satellite down link



### Restricted Bands by Use

Band (MHz)	Allocation/Use
22010-23120	22010-22500 MHz: radio astronomy, 22500-23000 MHz: broadcast satellite and radio astronomy, 23000-23070 MHz: fixed/inter-satellite/mobile, 23070-23120 MHz: radio astronomy
23600-24000	Radio astronomy
31200-31800	Radio astronomy
36430-36500	Radio astronomy
Above 38600	Satellite down link, Radio astronomy

3. Except as specified in paragraphs 5 and 6, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section K.3.4 of this Annex. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section K.3.4 of this Annex shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section K.3.4 of this Annex shall be demonstrated based on the average value of the measured emissions. The provisions in Section K.1.5 of this Annex apply to these measurements.

4. Except as specified in paragraphs 5 and 6 of this section, regardless of the field strength limits specified elsewhere in this Annex, the provisions of this part apply to emissions from any intentional radiator.

5. The following devices are exempt from the requirements of this part:

a. Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph 1, the sweep is never stopped with the fundamental emission within the bands listed in paragraph 1, and the fundamental emission is outside of the bands listed in paragraph 1 more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

b. Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

6. Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of Section K.3.5.16 of this Annex shall not exceed the limits specified in paragraph 2 of Section K.3.5.16.

7. While the Powerline Carriers (PLC) operate on a non-interference basis, in accordance with footnote US294 to the U.S. Table of Allocations, a Powerline Carrier Data Base (PLCDB) has been established to provide information necessary for identification and notification of potential interference between PLC and Federal authorized users and Federal Communications Commission licensees. The contact for this data base will be an FCC/NTIA recognized industry-operated entity. Periodic updates will be available through this entity, see Section of 8.3.27 of the manual.

### K.3.3 Conducted Limits

1. For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

2. The limit in paragraph 1 shall not apply to intentional radiators operated as carrier current systems in the frequency range of 450 kHz to 30 MHz. Such systems are subject to radiated emission limits as provided in Sections K.3.2 and K.3.4 of this Annex.

3. Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

### K.3.4 Radiated Emission Limits, General Requirements

1. Except as provided elsewhere in this part, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meters)	Measurement Distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100*	30
88-216	150*	3
216-960	200*	3
Above 960	500	3

\* Except as provided in paragraph 6, fundamental emissions from intentional radiators operating under this part shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, or 470-806 MHz.

2. In the emission table above, the tighter limit applies at the band edges.

3. The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other parts and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

4. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

5. The provisions in Section K.1.5 and 1.6 of this Annex for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this section.

6. Operation in the frequency bands allocated to TV broadcast stations:

a. Perimeter protection systems operating under the provisions of this section of Annex K in the frequency bands allocated to TV broadcast stations, as shown in Chapter 4 of this Manual, shall contain their fundamental emissions within the frequency bands 54-72 MHz and 76-88 MHz. Further, the use of such perimeter protection systems is limited to industrial, business and commercial applications.

b. Biomedical telemetry devices operating under the provisions of this section of Annex K in the frequency bands allocated to TV broadcast stations, as shown in Chapter 4 of this Manual, shall contain their fundamental emissions within the frequency band 312-566 MHz. Further, the marketing and the use of biomedical telemetry devices operating under this paragraph shall be limited to hospitals.

### **K.3.5 Radiated Emission Limits, Additional Provisions**

#### **K.3.5.1 Additional Provisions to the General Radiated Emission Limitations**

1. The regulations in Sections K.3.5.2 through K.3.5.19 of this Annex provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.

2. In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in Section K.3.4 of this Annex. In no case shall the level of the unwanted emission from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.

3. For those bands of frequencies where alternative radiated emission limitations apply and for which a frequency stability is not specified, it is recommended that the fundamental frequency be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4. Where the following sections specify limits on the bandwidth of the emissions, the bandwidth limits include the effects of frequency sweeping, frequency hopping, and other modulation techniques which may be employed.

#### **K.3.5.2 Operation in the Band 160-190 kHz**

1. The total input power to the final radio frequency stage (exclusive of filament or heater power) shall not exceed one watt.

2. The total length of the transmission line, antenna, and ground lead (if used) shall not exceed 15 meters.

3. All emissions below 160 kHz or above 190 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification may be based on

measurements at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions.

#### **K.3.5.3 Operation in the Band 510-1705 kHz**

1. The total input power of the final radio frequency stage (exclusive of filament or heater power) shall not exceed 100 milliwatts.
2. The total length of the transmission line, antenna and ground lead (if used) shall not exceed 3 meters.
3. All emissions below 510 kHz or above 1705 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification may be based on measurements at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions.

#### **K.3.5.4 Operation in the Band 525-1705 kHz**

1. The provisions of this section are restricted to the operation of an AM broadcast station on a college or university campus or on the campus of any other educational institution. Operation is restricted to the grounds of the campus. For the band 535-1705 kHz, the frequency of operation shall be chosen such that operation is not within the protected field strength contours of licensed AM stations.
2. On the campus, the field strength of emissions appearing outside of this frequency band shall not exceed the general radiated emission limits shown in Section K.3.4 of this Annex as measured from the radiating source. There is no limit on the field strength of emissions appearing within this frequency band, except that the provisions of Section 7.8 of the NTIA Manual continue to apply.
3. At the perimeter of the campus, the field strength of any emissions, including those within the frequency band 525-1705 kHz shall not exceed the general radiated emission limits in Section K.3.4 of this Annex.
4. The conducted limits specified in Section K.3.3 of this Annex apply to the radio frequency voltage on the public utility power lines outside of the campus. Due to the large number of radio frequency devices which may be used on the campus, contributing to the conducted emissions, as an alternative to measuring conducted emissions on the AC power lines outside of the campus, it is acceptable to demonstrate compliance with this provisions by measuring each individual intentional radiator employed in the system at the point where it connects to the AC power lines. As provided in Section K.3.3, paragraph 2 of this Annex, if only a carrier current system is employed, the AC power line conducted limits do not apply. However, the radiated emission limits provided in this section apply to carrier current systems.

#### **K.3.5.5 Operation in the Band 1.705-10 MHz**

1. The field strength of any emission within the band 1.705-10 MHz shall not exceed 100 microvolts/meter at a distance of 30 meters. However, if the bandwidth of the emission is less than 10% of the center frequency, the field strength shall not exceed 15 microvolts/meter or (the bandwidth of the device in kHz) divided by (the center frequency of the device in MHz) microvolts/meter at a distance of 30 meters, whichever is the higher level. For the purposes of this section, bandwidth is determined at the point 6 dB down from the modulated carrier. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.
2. The field strength of emissions outside of the band 1.705-10 MHz shall not exceed the general radiated emission limits in Section K.3.4 of this Annex.

#### **K.3.5.6 Operation Within the Band 13.553-13.567 MHz**

1. The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 30 meters.
2. The field strength of any emissions appearing outside of this band shall not exceed the general radiated emission limits shown in Section K.3.4 of this Annex.
3. The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### K.3.5.7 Operation Within the Band 26.96-27.28 MHz

1. The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

2. The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in Section K.3.4 of this Annex.

### K.3.5.8 Operation Within the Band 40.66-40.70 MHz

1. Unless operating pursuant to the provisions in Section K.3.5.9 of this Annex, the field strength of any emission within this band shall not exceed 1000 microvolts/meter at 3 meters.

2. As an alternative to the limit in paragraph 1, perimeter protection systems may demonstrate compliance with the following: the field strength of any emissions within this band shall not exceed 500 microvolts/meter at 3 meters, as determined using measurement instrumentation employing an average detector. The provisions of Section K.1.5 of this Annex for limiting peak emissions apply where compliance of these devices is demonstrated under this alternative emission limit.

3. The field strength of any emissions appearing outside of this band shall not exceed the general radiated emission limits in Section K.3.4 of this Annex.

4. The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### K.3.5.9 Periodic Operation in the Band 40.66-40.70 MHz and Above 70 MHz

1. The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph 5 of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmissions, such as voice or video, and data transmissions, are not permitted. The prohibition against data transmissions does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system. The following conditions shall be met to comply with the provisions for this periodic operation:

a. A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

b. A transmitter activated automatically shall cease transmission within 5 seconds after activation.

c. Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity or transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

d. Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

2. In addition to the provisions of Section K.3.2 of this Annex, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meters)	Field Strength of Spurious Emissions (microvolts/meters)
40.66-40.70	2,-250	225
70-130	1,250	125
130-174	1,250 to 3,750*	125 to 375*
174-260	3,750	375
260-470	2,750 to 12,500*	375 to 1,250*
Above 470	12,500	1,250

\* linear interpolations

a. The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band

edges.

b. Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section K.1.5 of this Annex for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section K.3.2 of this Annex shall be demonstrated using measurement instrumentation with a CISPR quasi-peak detector.

c. The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average limits shown in this table or to the general limits shown in Section K.3.4 of this Annex, as measured with a CISPR quasi-peak detector, whichever limit permits a higher field strength.

3. The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

4. For devices operating within the frequency band 40.66-40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be  $\pm 0.01\%$ . This frequency tolerance shall be maintained for a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5. Intentional radiators may operate at a periodic rate exceeding that specified in paragraph 1 and may be employed for any type of operation, including operation prohibited in paragraph 1, provided the intentional radiator complies with the provisions of paragraphs 2 through 4 of this section, except the field strength table in paragraph 2 is replaced by the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500*	50 to 150*
174-260	1,500	150
260-470	1,500 to 5,000*	150 to 500*
Above 470	5,000	500

\* linear interpolations

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

#### **K.3.5.10 Operation Within the Bands 46.60-46.98 MHz and 49.66-50.0 MHz**

1. The provisions shown in this section are restricted to cordless telephones.
2. An intentional radiator used as part of a cordless telephone system shall operate on one or more of the following frequency pairs:

Channel	Base Transmitter (MHz)	Handset Transmitter (MHz)
1	46.610	49.670
2	46.630	49.845
3	46.670	49.860
4	46.710	49.770
5	46.730	49.875
6	46.770	49.830
7	46.830	49.890
8	46.870	49.930
9	46.930	49.990
10	46.970	49.970

3. The field strength of the fundamental emission shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

4. The fundamental emission shall be confined within a 20 kHz band centered on the actual carrier frequency. Modulation products outside of this 20 kHz band shall be attenuated at least 26 dB below the level of the unmodulated carrier or to the general limits in Section K.3.4 of this Annex, whichever permits the higher emission levels. Emissions on any frequency more than 20 kHz removed from the center frequency shall consist solely of unwanted emissions and shall not exceed the general radiated emission limits in Section K.3.4 of this Annex.

5. If the device provides for the connection of external accessories, including external electrical input signals, the device must be tested with the accessories attached. The emission tests shall be performed with the device and accessories configured in a manner which tends to produce the maximum level of emissions within the range of variations that can be expected under normal operating conditions.

6. The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency. The tolerance shall be maintained for a temperature variation of -20 degrees C to +50 degrees C at normal supply voltage, and for variation in the primary voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

#### **K.3.5.11 Operation Within the Band 49.82-49.90 MHz**

1. The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

2. The field strength of any emissions appearing between the band edges and up to 10 kHz above and below the band edges shall be attenuated at least 26 dB below the level of the unmodulated carrier or to the general limits in Section K.3.4 of this Annex, whichever permits the higher emission levels. The field strength of any emissions removed by more than 10 kHz from the band edges shall not exceed the general radiated emission limits in Section K.3.4 of this Annex. All signals exceeding 20 microvolts/meter at 3 meters shall be reported in the application for certification.

#### **K.3.5.12 Operation in the Bands 72.0-73.0 MHz and 75.4-76.0 MHz**

1. The intentional radiator shall be restricted to use as an auditory assistance device.

2. Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the above specified frequency ranges.

3. The field strength of any emissions within the permitted 200 kHz band shall not exceed 80 millivolts/meter at 3 meters. The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed 1500 microvolts/meter at 3 meters. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

#### **K.3.5.13 Operation in the Band 88-108 MHz**

1. Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range 88-108 MHz.

2. The field strength of any emissions within the permitted 200 kHz band shall not exceed 250 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

3. The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in Section K.3.4 of this Annex.

#### **K.3.5.14 Operation in the Band 174-216 MHz**

1. Operation under the provisions of this section is restricted to biomedical telemetry devices.

2. Emissions from the device shall be confined within a 200 kHz band which shall lie wholly within the frequency range 174-216 MHz.

3. The field strength of any emissions radiated within the specified 200 kHz band shall not exceed 1500

microvolts/meter at 3 meters. The field strength of emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed 150 microvolts/meter at 3 meters. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

### **K.3.5.15 Operation in the Band 890-940 MHz**

1. Operation under the provisions of this section is restricted to devices that use radio frequency energy to measure the characteristics of a material. Devices operated pursuant to the provisions of this section shall not be used for voice communications or the transmission of any other type of message.

2. The field strength of any emissions radiated within the specified frequency band shall not exceed 500 microvolts/meter at 30 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

3. The field strength of emissions radiated on any frequency outside of the specified band shall not exceed the general radiated emission limits in Section K.3.4 of this Annex.

4. The device shall be self-contained with no external or readily accessible controls which may be adjusted to permit operation in a manner inconsistent with the provisions of this section. Any antenna that may be used with the device shall be permanently attached thereto and shall not be readily modifiable by the user.

### **K.3.5.16 Operation Within the Bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz and 24075-24175 MHz**

1. Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

2. The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meters)	Field Strength of Harmonics (millivolts/meters)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

a. Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in Section K.3.2 of this Annex, shall not exceed the field strength limits shown in Section K.3.4 of this Annex. Harmonic emissions in the restricted bands at and above 17.7 GHz, and below 40 GHz, shall not exceed the following field strength limits:

(1) For field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(2) For all other field disturbance sensors, 7.5 mV/m.

(3) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands fully comply with the limits given in Section K.3.4 of this Annex. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

b. Field strength limits are specified at a distance of 3 meters.

c. Emissions radiated outside of the specified frequency bands, except harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section K.3.4 of this Annex, whichever is the lesser attenuation.

d. The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.

### **K.3.5.17 Operation Within the Bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**

1. Operation under the provisions of this section is limited to frequency hopping and direct sequence spread spectrum intentional radiators that comply with the following provisions:

a. Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(1) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(2) Frequency hopping systems operating in the 2400-2483.5 MHz and 5725-5850 MHz bands shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

b. For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

2. The maximum peak output power of the intentional radiator shall not exceed the following:

a. For frequency hopping systems operating in the 2400-2483.5 MHz or 5725-5850 MHz band and for all direct sequence systems: 1 watt.

b. For frequency hopping systems operating in the 902-928 MHz: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under subparagraph 1.a.(1) of this section.

c. Except as shown below, with a transmitting antenna having directional gain greater than 6 dBi, the peak output power from the intentional radiator shall be reduced below the above stated values by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(1) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(2) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

(3) Fixed, point-to-point operation, as used in subparagraphs 2.c.(1) and 2.c.(2) of this subsection, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(4) Systems operating under the provisions of this part shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the national guidelines expressed in this manual in Section 8.2.28.

3. In any 100 kHz bandwidth outside the frequency band, in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, whichever yields the highest value. Attenuation below the general limits specified in paragraph 1 of Section K.3.4 is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section K.3.2, must also comply with the radiated emission limits specified in paragraph 1 of Section K.3.4.

4. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5. The processing gain of a direct sequence system shall be at least 10 dB. The processing gain represents the improvement to the received signal-to-noise ratio, after filtering to the information bandwidth, from the



spreading/despreading function. The processing gain may be determined using one of the following methods:

- a. As measured at the demodulated output of the receiver: the ratio in dB of the signal-to-noise ratio with the system spreading code turned off to the signal-to-noise ratio with the systems spreading code turned on.
- b. As measured using the CW jamming margin method: a signal generator is stepped in 50 kHz increments across the passband of the system, recording at each point the generator level required to produce the recommended Bit Error Rate (BER). This level is the jammer level the output power of the intentional radiator is measured at the same point. Then jammer-to-signal ratio (J/S) is then calculated, discarding the worst 20% of the J/S data points. The lowest remaining J/S ratio is used to calculate the processing gain, as follows:  $G_p = (S/N)_O + M_j + L_{sys}$ , where  $G_p$ =processing gain of the system,  $(S/N)_O$ =signal-to-noise ratio required for the chosen BER,  $M_j$ =J/S ratio, and  $L_{sys}$ =system losses.

Note that total losses in a system, including intentional radiator and receiver, should be assumed to be no more than 2 dB.

6. Hybrid systems that employ a combination of both direct sequence and frequency hopping modulation techniques shall achieve a processing gain of at least 17 dB from the combined techniques. The frequency hopping operation of the hybrid system, with the direct sequence operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The direct sequence operation of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph 4 of this Section.

7. Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

8. The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

NOTE: Spread spectrum systems are sharing these bands on a non-interference basis with systems supporting critical Federal requirements that have been allocated the usage of these bands, secondary only to ISM equipment. Many of these Federal systems are airborne radiolocation systems that emit a high EIRP which can cause interference to other users. Also, investigations of the effect of spread spectrum interference to U.S. Government operations in the 902-938 MHz band may require a future decrease in the power limits allowed for spread spectrum operation.

### **K.3.5.18 Operation Within the Bands 902-928 MHz 2400-2483.5 MHz, 5725-5875 MHz and 24.0-24.25 GHz**

1. The field strength from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

2. Field strength limits are specified at a distance of 3 meters.

3. Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section K.3.4 of this Annex, whichever is the lesser attenuation.

4. As shown in Section K.1.5 of this Annex, for frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

### **K.3.5.19 Operation Within the Bands 2.9-3.26 GHz, 3.267-3.332 GHz, 3.339-3.3458 GHz and 3.358-3.6 GHz**

1. Operation under the provisions of this section is limited to automatic vehicle identification systems (AVIS) which use swept frequency techniques for the purpose of automatically identifying transportation vehicles.
2. The field strength anywhere within the frequency range swept by the signal shall not exceed 3000 microvolts/meter/MHz at 3 meters in any direction. Further, an AVIS, when in its operating position, shall not produce a field strength greater than 400 microvolts/meter/MHz at 3 meters in any direction within  $\pm 10$  degrees of the horizontal plane. In addition to the provisions of Section K.3.2 of this Annex, the field strength of radiated emissions outside the frequency range swept by the signal shall be limited to a maximum of 100 microvolts/meter/MHz at 3 meters, measured from 30 MHz to 20 GHz for the complete system. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section K.1.5 of this Annex for limiting peak emissions apply.
3. The minimum sweep repetition rate of the signal shall not be lower than 4000 sweeps per second, and the maximum sweep repetition rate of the signal shall not exceed 50,000 sweeps per second.
4. An AVIS shall employ a horn antenna or other comparable directional antenna for signal emission.
5. Provision shall be made so that signal emission from the VIS shall occur only when the vehicle to be identified is within the radiated field of the system.

### **K.3.5.20 Unlicensed National Information Infrastructure Devices**

#### **K.3.5.20.1 General**

These paragraphs set out the regulations for Unlicensed National Information Infrastructure devices operating in the 5.15-5.35 GHz and 5.725-5.825 GHz bands. The provisions of all other parts of this Annex apply to unlicensed devices except where specific provisions are contained in this part. The requirements of this part apply only to the radio transmitter contained in the Section K.3.5.20. Other aspects of the operation of such devices may be subject to requirements contained elsewhere in this annex. In particular, such devices that include digital circuitry not directly associated with the radio transmitter in this section are also subject to the requirement for unintentional radiators found elsewhere in this annex.

#### **K.3.5.20.2 U-NII Definitions**

**Average Symbol Envelope Power:** The average symbol envelope power is the average, taken over all symbols in the signaling alphabet, of the envelope power for each symbol.

**Digital Modulation:** The process by which the characteristics of a carrier wave are varied among a set of predetermined discrete values in accordance with a digital modulating function as specified in document ANSI C63.17-1998.

**Emission Bandwidth:** For the purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emission bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

**Peak Power Spectral Density:** The peak power spectral density is the maximum power spectral density, within the specified measurement bandwidth, within the device's operating band.

**Peak Transmit Power:** The maximum transmit power as measured over an interval of time of at most  $30/B$  (where  $B$  is the 26-dB emission bandwidth in MHz) or the transmission pulse duration of the device, whichever is less, under all conditions of modulation.

**Power Spectral Density:** The power spectral density is the total energy output per unit bandwidth from a pulse or sequence of pulses for which the transmit power is at its peak or maximum level, divided by the total duration of the pulses. This total time does not include the time between pulses during which the transmit power is off or below its maximum level.

**Pulse:** A pulse is a continuous transmission of a sequence of modulation symbols, during which the average symbol envelope power is constant.

**Transmit Power:** The total energy transmitted over a time interval of at most  $30/B$  (where  $B$  is the 26 dB emission

bandwidth of the signal in hertz) or the duration of the transmission pulse, whichever is less, divided by the interval duration.

U-NII devices: Intentional radiators operating in the frequency bands 5.15 - 5.35 GHz and 5.725 -5.825 GHz that use wideband digital modulation techniques and provide a wide array of high data rate mobile and fixed communications for individuals, businesses, and institutions.

### **K.3.5.20.3 U-NII General Technical Requirements**

a. Power limits:

(1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10\log B$  (where B is the 26-dB emission bandwidth in MHz). In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10\log B$  (where B is the 26-dB emission bandwidth in MHz). In addition, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed 1 W or  $17 \text{ dBm} + 10\log B$  (where B is the 26-dB emission bandwidth in MHz). In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

NOTE: The NTIA strongly recommends that parties employing these devices to provide critical communications services should determine if there are any nearby Federal radar systems that could affect their operation.

(4) The peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement conforming to the above definitions for the emission in question.

(5) The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

(6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

b. Undesirable Emission Limits: Except as shown in Paragraph b.(6) of this Section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz

band shall not exceed an EIRP of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

(3) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

(4) The above emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section K.3.4. Further, any devices using an AC power line are required to comply also with the conducted limits set forth in Section K.3.3.

(6) The provisions of Section K.3.2 of this Annex apply to intentional radiators operating under this section.

(7) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

c. The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

d. Any device that operates in the 5.15-5.25 GHz band shall use a transmitting antenna that is an integral part of the device.

e. Within the 5.15-5.25 GHz band, devices will be restricted to indoor operations to reduce any potential for harmful interference to aeronautical radionavigation and co-channel MSS operations.

f. Devices are subject to the radio frequency radiation exposure requirements specified in Section 8.2.28, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the NTIA upon request.

g. Manufacturers of these devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

### **K.3.5.21 Unlicensed Personal Communications Service Devices**

#### **K.3.5.21.1 PCS General**

This section sets out the regulations for unlicensed personal communication service (PCS) operating in the 1920-1930 MHz band.

#### **K.3.5.21.2 PCS Definitions**

**Asynchronous devices:** Devices that transmit RF energy at irregular time intervals, as typified by local area network data systems.

**Coordinatable PCS device:** PCS devices whose geographical area of operation is sufficiently controlled either by necessity of operation with a fixed infrastructure or by disabling mechanisms to allow adequate coordination of their locations relative to incumbent fixed microwave facilities.

**Emission bandwidth:** For purposes of this section the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Isochronous devices: Devices that transmit at a regular interval, typified by time-division voice systems.

Non-coordinatable PCS device: A PCS device that is capable of randomly roaming and operating in geographic areas containing incumbent microwave facilities such that operation of the PCS device will potentially cause harmful interference to the incumbent microwave facilities.

Peak transmit power: The peak power output as measured over an interval of time equal to the frame rate or transmission burst of the device under all conditions of modulation. Usually this parameter is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used.

Personal Communications Service (PCS) Devices [Unlicensed]: Intentional radiators operating in the frequency bands 1910-1930 MHz and 2390-2400 MHz that provide a wide array of mobile and ancillary fixed communication services to individuals and businesses.

Spectrum window: An amount of spectrum equal to the intended emission bandwidth in which operation is desired.

Sub-band: For purposes of this section the term sub-band refers to the spectrum allocated for isochronous or asynchronous transmission.

Thermal noise power: The noise power in watts defined by the formula  $N=kTB$  where N is the noise power in watts, k is Boltzmann's constant, T is the absolute temperature in degrees Kelvin (e.g., 295° K) and B is the emission bandwidth of the device in hertz.

Time window: An interval of time in which transmission is desired.

### **K.3.5.21.3 PCS Equipment Authorization Requirement**

PCS devices operating under this Annex shall be authorized by the Commission under the procedures in Title 47, Subpart J of Part 2 of the FCC Rules and Regulations before marketing. The application for authorization must contain sufficient information to demonstrate compliance with the requirements of this section.

### **K.3.5.21.4 PCS Coordination with Fixed Microwave Service**

a. Operations of unlicensed PCS devices are required to protect systems in the Private Operational-Fixed Microwave Service. Coordination in the Fixed Microwave services is facilitated through UTAM, Inc. (Unlicensed Transition and Management for Microwave relocation in the 2 GHz band). Funding for coordination and relocation of fixed microwave systems, when necessary, is covered by fees paid to UTAM by the manufacturers of the unlicensed PCS devices.

b. Operations under the provisions of this section are required to protect systems in the Private Operational-Fixed Microwave Service operating within the 1850-1990 MHz band until the dates and conditions specified in the FCC Rules and Regulations (under Title 47, Part 101.69 - 101.73) of this section for termination of primary status. Interference protection is not required for Title 47, Part 101 stations in this band licensed on a secondary basis.

c. The operator of a PCS device that is relocated from the coordinated area specified by UTAM, Inc., must cease operating the device until coordination for the new location is verified by UTAM, Inc. UTAM may be contacted at 800-429-8826 or by contacting UTAM, Inc. directly at UTAM, Inc., 991 US Highway 22, Suite 104, P.O. Box 8126, Bridgewater, NJ 08807 (Phone: 908-526-3636 or their FAX: 908-526-0115).

### **K.3.5.21.5 PCS Labeling Requirements**

In addition to the labeling requirements of Section K.1.4, all devices operating in the frequency band 1910-1930 MHz authorized under this section must bear a prominently located label with the following statement:

Installation of this equipment is subject to notification and coordination with UTAM, Inc. Any relocation of this equipment must be coordinated through, and approved by UTAM. Directions for contacting UTAM are specified in subparagraph 4.c of this may be contacted at 800-429-8826 or by contacting UTAM, Inc. directly at: UTAM, Inc., 991 US Highway 22, Suite 104, P.O. Box 8126, Bridgewater, NJ 08807 (Phone: 908-526-3636 or their FAX: 908-526-0115).

### **K.3.5.21.6 PCS Measurement Procedures**

Measurements must be made in accordance with Annex K, Section K.1.5, except where specific procedures are specified in Section K.3.5.21. If no guidance is provided, the measurement procedure must be in accordance with

good engineering practice.

#### **K.3.5.21.7 PCS Conducted Limits**

An unlicensed PCS device that is designed to be connected to the public utility (AC) power line must meet the limits specified in Section K.3.3 of this Annex.

#### **K.3.5.21.8 PCS Antenna Requirement**

An unlicensed PCS device must meet the antenna requirement of Section K.3.1 of this Annex.

#### **K.3.5.21.9 PCS General Technical Requirements**

- a. [Reserved]
- b. All transmissions must use only digital modulation techniques.
- c. Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in hertz. Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.
- d. Power spectral density shall not exceed 3 milliwatts in any 3 kHz bandwidth as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.
- e. The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.
- f. The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.
- g. Notwithstanding other technical requirements specified in this section, attenuation of emissions below the general emission limits in Section K.3.4 is not required.
- h. Where there is a transition between limits, the tighter limit shall apply at the transition point.
- i. Unlicensed PCS devices operating under the provision of this part shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the national guidelines expressed in this manual in Section 8.2.28.

#### **K.3.5.21.10 Specific Requirements for Devices Operating in the 1920-1930 MHz Sub-Band**

- a. Operation shall be contained within one of eight 1.25 MHz channels starting with 1920-1921.25 MHz and ending with 1928.75-1930 MHz. Further sub-division of a 1.25 MHz channel is permitted with a reduced power level, as specified in Section K.3.5.21 subparagraph 9.c., but in no event shall the emission bandwidth be less than 50 kHz.
- b. Intentional radiators with an intended emission bandwidth less than 625 kHz shall start searching for an available time and spectrum window within 3 MHz of the sub-band edge at 1920 MHz and search upward from that point. Devices with an intended emission bandwidth greater than 625 kHz shall start searching for an available time and spectrum window within 3 MHz of the sub-band edge at 1930 MHz and search downward from that point.
- c. Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:
  - (1) Immediately prior to initiating transmission, devices must monitor the combined time and spectrum windows in which they intend to transmit for a period of at least 10 milliseconds for systems designed to use a 10 millisecond or shorter frame period or at least 20 milliseconds for systems designed to use a 20 millisecond frame period.
  - (2) The monitoring threshold must not be more than 30 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth of the device.
  - (3) If no signal above the threshold level is detected, transmission may commence and continue with the same emission bandwidth in the monitored time and spectrum windows without further monitoring. However, occupation of the same combined time and spectrum windows by a device or group of cooperating devices

continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

(4) Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signalling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.

(5) If access to spectrum is not available as determined by the above, and a minimum of 40 duplex system access channels are defined for the system, the time and spectrum windows with the lowest power level below a monitoring threshold of 50 dB above the thermal noise power determined for the emission bandwidth may be accessed. A device utilizing the provisions of this paragraph must have monitored all access channels defined for its system within the last 10 seconds and must verify, within the 20 milliseconds (40 milliseconds for devices designed to use a 20 millisecond frame period) immediately preceding actual channel access that the detected power of the selected time and spectrum windows is no higher than the previously detected value. The power measurement resolution for this comparison must be accurate to within 6 dB. No device or group of cooperating devices located within 1 meter of each other shall occupy more than three 1.25 MHz channels during any frame period. Devices in an operational state that are utilizing the provision of this section are not required to use the search provisions of (b) above.

(6) If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

(7) The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and have a maximum reaction time less than  $50 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds. If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be  $35 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds but shall not be required to be less than 35 microseconds.

(8) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

(9) Devices that have a power output lower than the maximum permitted under the rules may increase their monitoring detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

(10) An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

(11) An initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within the 1.25 MHz frequency channel(s) already occupied by that device or co-located co-operating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in the intended transmit window by the initiating device may commence.

(12) The provisions of Section K.3.5.21 subparagraph 11.c(10) or Section K.3.5.21 subparagraph 11.c(11) shall not be used to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other devices.

d. Emissions shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the channel edges and 1.25 MHz above or below the channel; 50 dB between 1.25 and 2.5 MHz above or below the channel; and 60 dB at 2.5 MHz or greater above or below the channel. Systems that further sub-divide a 1.25 MHz channel into X sub-channels must comply with the following emission mask: In the bands between 1B and 2B measured from the center of the emission bandwidth the total power emitted by the device shall be at least 30 dB below the transmit power permitted for that device; in the bands between 2B and 3B measured from the center of the emission bandwidth the total power emitted by an intentional radiator shall be at least 50 dB below the transmit power permitted for that radiator; in the bands between 3B and the 1.25 MHz channel edge the total power emitted

by an intentional radiator in the measurement bandwidth shall be at least 60 dB below the transmit power permitted for that radiator. "B" is defined as the emission bandwidth of the device in MHz. Compliance with the emission limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

e. The frame period (a set of consecutive time slots in which the position of each time slot can be identified by reference to a synchronizing source) of an intentional radiator operating in these sub-bands shall be 20 milliseconds/X where X is a positive whole number. Each device that implements time division for the purposes of maintaining a duplex connection on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 50 parts per millions (ppm). Each device which further divides access in time in order to support multiple communication links on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 10 ppm. The jitter (time-related, abrupt, spurious variations in the duration of the frame interval) introduced at the two ends of such a communication link shall not exceed 25 microseconds for any two consecutive transmissions. Transmissions shall be continuous in every time and spectrum window during the frame period defined for the device.

f. The frequency stability of the carrier frequency of the intentional radiator shall be maintained within  $\pm 10$  ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of  $-20^{\circ}$  to  $+50^{\circ}$  degrees C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of  $20^{\circ}$  C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

### **K.3.5.22 Operation within the Band 57-64 GHz**

1. Operation under the provisions of this section is not permitted for the following products:

a. Equipment used on aircraft or satellites,  
b. Field disturbance sensors, including vehicle radar systems, unless the field disturbance sensors are employed for fixed operation. For the purposes of this section, the reference to fixed operation includes field disturbance sensors installed in fixed equipment, even if the sensor itself moves within the equipment.

2. Within the 57-64 GHz band, emission levels shall not exceed the following:

a. For products other than fixed field disturbance sensors, the average power density of any emission, measured during the transmit interval, shall not exceed  $9 \text{ } \mu\text{W} / \text{cm}^2$ , as measured three meters from the radiating structure, and the peak power density of any emission shall not exceed  $18 \text{ } \mu\text{W} / \text{cm}^2$ , as measured three meters from the radiating structure.

b. For fixed field disturbance sensors that occupy 500 MHz or less of bandwidth and that are contained wholly within the frequency band 61.0-61.5 GHz, the average power density of any emission, measured during the transmit interval, shall not exceed  $9 \text{ } \mu\text{W} / \text{cm}^2$ , as measured three meters from the radiating structure, and the peak power density of any emission shall not exceed  $18 \text{ } \mu\text{W} / \text{cm}^2$ , as measured three meters from the radiating structure. In addition, the average power density of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-64 GHz band, shall not exceed 9 nW/cm, as measured three meters from the radiating structure, and the peak power density of any emission shall not exceed  $18 \text{ nW} / \text{cm}^2$ , as measured three meters from the radiating structure.

c. For fixed field disturbance sensors other than those operating under the provisions of paragraph (b)(2) of this section, the peak transmitter output power shall not exceed 0.1 mW and the peak power density shall not exceed  $9 \text{ nW} / \text{cm}^2$  at a distance of three meters.

d. Peak power density shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-64 GHz band and has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

e. The average emission limits shall be calculated, based on the measured peak levels, over the actual time period during which transmission occurs.

3. Limits on spurious emissions:

a. The power density of any emissions outside the 57-64 GHz band shall consist solely of spurious emissions.

b. Radiated emissions below 40 GHz shall not exceed the general limits in Section 15.209.



c. Between 40 GHz and 200 GHz, the level of these emissions shall not exceed  $90 \text{ pW/cm}^2$  at a distance of three meters.

d. The levels of the spurious emissions shall not exceed the level of the fundamental emission.

4. Only spurious emissions and transmissions related to a publicly-accessible coordination channel, whose purpose is to coordinate operation between diverse transmitters with a view towards reducing the probability of interference throughout the 57-64 GHz band, are permitted in the 57-57.05 GHz band.

NOTE: The 57-57.05 GHz is reserved exclusively for a publicly-accessible coordination channel. The development of standards for this channel shall be performed pursuant to authorizations issued under Part 5 of this chapter.

5. Except as specified below, the total peak transmitter output power shall not exceed 500 mW.

a. Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, if not stationary during normal operation (e.g. for frequency hopping devices).

b. Peak transmitter output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-64 GHz band and that has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

c. For purposes of demonstrating compliance with this paragraph, corrections to the transmitter output power may be made due to the antenna and circuit loss.

6. Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

7. Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

8. Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

9. For all transmissions that emanate from inside a building, within any one second interval of signal transmission, each transmitter with a peak output power equal to or greater than 0.1 mW or a peak power density equal to or greater than  $3 \text{ nW/cm}^2$ , as measured three meters from the radiating structure, must transmit a transmitter identification at least once. Each application for equipment authorization must declare that the equipment that will be used inside a building contains the required transmitter identification feature and must specify a method whereby interested parties can obtain sufficient information, at no cost, to enable them to fully detect and decode this transmitter identification information. Upon the completion of decoding, the transmitter identification data block must provide the following fields:

a. FCC Identifier, which shall be programmed at the factory,

b. Manufacturer's serial number, which shall be programmed at the factory,

c. Provision for at least 24 bytes of data relevant to the specific device, which shall be field programmable.

The grantee must implement a method that makes it possible for users to specify and update this data. The recommended content of this field is information to assist in contacting the operator.

## K.3.6 Operation of Non-Licensed Ultrawideband Systems Devices

### K.3.6.1 Definitions:

**Ultrawideband (UWB) Bandwidth:** UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated  $f_H$  and the lower boundary is designated  $f_L$ . The frequency at which the highest radiated emission occurs is designated  $f_m$ .

**Center frequency:** The center frequency,  $f_C$ , equals  $(f_H + f_L)/2$ .

**Fractional bandwidth:** The fractional bandwidth equals  $2(f_H - f_L)/(f_H + f_L)$ .

**UWB transmitter:** An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

**Imaging system:** A general category of UWB consisting of ground penetrating radar systems, medical imaging systems, wall imaging systems through-wall imaging systems and surveillance systems. As used in this subpart, imaging systems do not include systems designed to detect the location of tags or systems used to transfer voice or data information.

**Ground penetrating radar (GPR) system:** A field disturbance sensor that is designed to operate only when in contact with, or within 1 meter of, the ground for the purpose of detecting or obtaining the images of buried objects or determining the physical properties within the ground. The energy from the GPR is intentionally directed down into the ground for this purpose.

**Medical imaging system:** A field disturbance sensor that is designed to detect the location or movement of objects within the body of a person or animal.

**Wall imaging system:** A field disturbance sensor that is designed to detect the location of objects contained within a "wall" or to determine the physical properties within the "wall." The "wall" is a concrete structure, the side of a bridge, the wall of a mine or another physical structure that is dense enough and thick enough to absorb the majority of the signal transmitted by the imaging system. This category of equipment does not include products such as "stud locators" that are designed to locate objects behind gypsum, plaster or similar walls that are not capable of absorbing the transmitted signal.

**Through-wall imaging system:** A field disturbance sensor that is designed to detect the location or movement of persons or objects that are located on the other side of an opaque structure such as a wall or a ceiling. This category of equipment may include products such as "stud locators" that are designed to locate objects behind gypsum, plaster or similar walls that are not thick enough or dense enough to absorb the transmitted signal.

**Surveillance system:** A field disturbance sensor used to establish a stationary radio frequency perimeter field that is used for security purposes to detect the intrusion of persons or objects.

**EIRP:** Equivalent isotropically radiated power, i.e., the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. The EIRP, in terms of dBm, can be converted to a field strength, in dBV/m at three meters, by adding 95.2. EIRP refers to the highest signal strength measured in any direction and at any frequency from the UWB device, as tested in accordance with the procedures specified later in this section.

**Hand held:** A hand held device is a portable device, such as a lap top computer or a Personal Data Assistant, that is primarily hand held while being operated and that does not employ a fixed infrastructure.

### K.3.6.2 Qualification Statements

The provisions of footnote US246 to the Table of Frequency Allocations and the frequency bands listed in Section K.3.2 do not apply to systems and devices operated under this section.2. A UWB device that contains digital circuitry not directly associated with the operation of the transmitter also is subject to the requirements for unintentional radiators in Section K.2 of this Annex. Similarly, an associated receiver that operates (tunes) within the frequency range 30 MHz to 960 MHz is subject to the requirements for unintentional radiators in Section K.2 of this Annex K.

### K.3.6.3 Technical Requirements for Low Frequency Imaging Systems

1. The UWB bandwidth of an imaging system operating under the provisions of this Section must be below 960 MHz.

2. Operation under the provisions of this section is limited to GPRs, wall and through-wall imaging systems. These systems require coordination, as detailed in Section K.3.6.9 of this Annex.

3. An imaging system shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. In addition, it is permissible to operate an imaging system by remote control provided the imaging system ceases transmission within 10 seconds of the remote switch being released by the operator.

4. The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section K.3.4 of this Annex. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960-1610	-65.3
1610-1990	-53.3
Above 1990	-51.3

5. In addition to the radiated emission limits specified in the above table, UWB transmitters shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	-75.3
1559-1610	-75.3

6. The peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs,  $f_M$ , shall not exceed 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described Section K.3.6.10.

#### **K.3.6.4 Technical Requirements for Mid-Frequency Imaging Systems**

1. The UWB bandwidth of an imaging system operating under the provisions of this section must be contained between 1990 MHz and 10,600 MHz.

2. Operation under the provisions of this section is limited to through-wall imaging systems and fixed surveillance systems. These systems require coordination as detailed in Section K.3.6.9 of this Annex.

3. A through-wall imaging system shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. In addition, it is permissible to operate an imaging system by remote control provided the imaging system ceases transmission within 10 seconds of the remote switch being released by the operator.

4. The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section K.3.4 of this Annex. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960-1610	-53.3
1610-1990	-51.3
1990-10600	-41.3
Above 10600	-51.3

5. In addition to the radiated emission limits specified in the above table, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	-63.3
1559-1610	-63.3

6. The peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs,  $f_M$ , shall not exceed 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described Section K.3.6.10.

### **K.3.6.5 Technical Requirements for High Frequency Imaging Systems**

1. The UWB bandwidth of an imaging system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

2. Operation under the provisions of this section is limited to GPRs and wall imaging systems and medical imaging systems used at the direction of, or under the supervision of, a licensed health care practitioner. The operation of these systems requires coordination, as detailed in Section K.3.6.9 of this Annex.

3. An imaging system shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. In addition, it is permissible to operate an imaging system by remote control provided the imaging system ceases transmission within 10 seconds of the remote switch being released by the operator.

4. The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section K.3.4 of this Annex. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960-1610	-65.3
1610-1990	-53.3
1990-3100	-51.3
3100-10600	-41.3
Above 10600	-51.3

5. In addition to the radiated emission limits specified in the above table, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	-75.3
1559-1610	-75.3

6. The peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs,  $f_M$ , shall not exceed 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described later in Section K.3.6.10.

### **K.3.6.6 Technical Requirements for Indoor UWB Systems**

1. Operation under the provisions of this section is limited to UWB transmitters employed solely for indoor operation.

a. Indoor UWB devices, by the nature of their design, must be capable of operation only indoors. The necessity to operate with a fixed indoor infrastructure (e.g., a transmitter that must be connected to the AC power lines, may be considered sufficient to demonstrate this).

b. The emissions from equipment operated under this section shall not be intentionally directed outside of the building in which the equipment is located, such as through a window or a doorway, to perform an outside function, such as the detection of persons about to enter a building.

c. The use of outdoor mounted antennas (e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited).

d. Field disturbance sensors installed inside of metal or underground storage tanks are considered to operate indoors provided the emissions are directed towards the ground.

e. A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.

2. The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

3. The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section K.3.4 of this Annex. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960-1610	-75.3
1610-1990	-53.3
1990-3100	-51.3
3100-10600	-41.3
Above 10600	-51.3

4. In addition to the radiated emission limits specified in the above table, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

5. The peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM, shall not exceed 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described Section K.3.6.10.

6. UWB systems operating under the provisions of this section shall bear the following or similar statement in a conspicuous location on the device or in the instruction manual supplied with the device: *"This equipment may only be operated indoors"*

### **K.3.6.7 Technical Requirements for Handheld UWB Systems**

1. UWB devices operating under the provisions of this section must be hand held (i.e., they are relatively small devices that are primarily hand held while being operated and do not employ a fixed infrastructure).

a. A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgment from the associated receiver that its transmission is being received. An acknowledgment of reception must continued to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

b. The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand-held UWB device.

c. UWB devices operating under the provisions of this section may operate indoors or outdoors.

2. The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

3. The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section K.3.4 of this Annex. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

4. In addition to the radiated emission limits specified in the above table, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

5. The peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs,  $f_M$ , shall not exceed 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described Section K.3.6.10.

### **K.3.6.8 Technical Requirements Applicable to All UWB Devices**

1. Operation of UWB devices onboard an aircraft, a ship or a satellite is not prohibited. However, because of safety concerns, use by passengers aboard such vessels is prohibited. Moreover, UWB systems involving mission critical or safety of life services, which must be protected from other emitters, or involving aggregations of UWB devices aboard several mobile platforms cannot be operated under these provisions.

2. Digital circuitry that is used only to enable the operation of a transmitter and that does not control additional functions or capabilities is not classified as a digital device. Instead, the emissions from that digital circuitry are subject to the same limits as those applicable to the transmitter. If it can be clearly demonstrated that an emission from a UWB transmitter is due solely to emissions from digital circuitry contained within the transmitter and that the emission is not intended to be radiated from the transmitter's antenna, the limits shown in Section K.3.4 of this Annex shall apply to that emission rather than the limits specified in this section.

3. Within the tables in the above rule sections, the tighter emission limit applies at the band edges. Radiated emission levels at and below 960 MHz are based on measurements employing a CISPR quasi-peak detector. Radiated emission levels above 960 MHz are based on RMS average measurements over a 1 MHz resolution bandwidth. The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time. If pulse gating is employed where the transmitter is quiescent for intervals that are long compared to the nominal pulse repetition interval, measurements shall be made with the pulse train gated on.

4. The frequency at which the highest radiated emission occurs,  $f_M$ , must be contained within the UWB bandwidth.

5. Imaging systems may be employed only for the type of information exchange described in their specific definitions contained earlier in this section. The detection of tags or the transfer of data or voice information is not permitted under the standards for imaging systems.

6. When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs,  $f_M$ . If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be  $20 \log (RBW/50)$  dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using  $E(\text{dB}\mu\text{V/m}) = P(\text{dBm EIRP}) + 95.2$ .

7. The highest frequency employed in Section K.1.6 of this Annex to determine the frequency range over which radiated measurements are made shall be based on the center frequency,  $f_C$ , unless a higher frequency is generated within the UWB device. For measuring emission levels, the spectrum shall be investigated from the lowest frequency generated in the UWB transmitter, without going below 9 kHz, up to the frequency range shown in Section K.1.6 of this Annex or up to  $f_C + 3/(\text{pulse width in seconds})$ , whichever is higher. There is no requirement to measure emissions beyond 40 GHz provided  $f_C$  is less than 10 GHz; beyond 100 GHz if  $f_C$  is at or above 10 GHz and below 30 GHz; or beyond 200 GHz if  $f_C$  is at or above 30 GHz.

8. Agencies are reminded of the other standards and requirements in this Annex such as a limit on emissions conducted onto the AC power lines.

### **K.3.6.9 Coordination Requirements**

1. UWB imaging systems require coordination through the FAS before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.

2. The users of UWB imaging devices shall supply detailed operational areas to NTIA. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographical area of operation, and the FCC ID number and other nomenclature of the UWB device.

3. Users of authorized, coordinated UWB systems may transfer them to other qualified users and to different locations upon coordination of change of ownership or location with the FAS and coordination with existing authorized operations.

4. The FAS coordination report shall include any needed constraints that apply to day-to-day operations. Such constraints could specify prohibited areas of operations or areas located near authorized radio stations for which additional coordination is required before operation of the UWB equipment. If additional local coordination is required, a local coordination contact will be provided.

### **K.3.6.10 Measurement Procedures**

These measurement procedures are intended to provide general guidance for compliance measurements of UWB devices developed pursuant to Section 7.9 of this Manual. Except as otherwise described herein, measurements shall be made in accordance with the procedures specified in Part 15 of Title 47 of the Code of Federal Regulations.

a. Ground penetrating radars (GPRs) and wall imaging systems shall be tested under conditions that are representative of actual operating conditions. UWB devices intended for these types of application shall be compliance tested with the transducer at an operationally representative height above a twenty-inch thick bed of dry sand. The use of this medium, particularly for larger GPRs (e.g., those that are towed behind vehicles), will likely preclude the use of a turntable in the measurement procedure. For these cases, directionality gradients shall be analyzed and measurements shall be performed at a sufficient number of radials around the equipment under test to determine the radial at which the field strength values of the radiated emissions are maximized.

b. Field strength measurements of through-wall imaging systems may be made with a "thick gypsum or drywall board placed between the UWB device antenna and the measurement system antenna.

c. RMS average field strength measurements, required for all frequencies above 960 MHz, shall be made using techniques to obtain true RMS average. This can be accomplished by using a spectrum analyzer that incorporates a RMS detector. The resolution bandwidth of the analyzer shall be set to 1 MHz, the RMS detector selected, and a video integration time of 1 ms or less is to be used. If the transmitter employs pulse gating, in which the transmitter is quiescent for intervals that are long compared to the nominal pulse repetition interval, all measurements shall be made while the pulse train is gated on. Alternatively, a true RMS level can be measured using a spectrum analyzer that does not incorporate a RMS detector. This approach requires a multiple step technique beginning with a peak detection scan of the UWB spectrum with a RBW of 1 MHz and a VBW of no less than 1 MHz. The resulting trace is to be used to identify the frequency and bandwidth of the five highest peaks in the spectrum. The analyzer is then to be placed in a "zero span" mode, with a RBW of 1 MHz, a video bandwidth equal to or greater than 1 MHz, and a detector selected that does not distort or smooth the instantaneous signal levels (e.g., a "sample" detector). With these settings, a minimum of ten independent instantaneous points, representing the highest amplitude readings, are to be obtained during the time that a pulse is present, in each 1 MHz frequency bin across the bandwidth of each of the five highest peaks identified in the previous step. Note that when the PRF of the device under test is less than the measurement bandwidth of 1 MHz, a significant number of samples may be required to ensure that a minimum of 10 samples with the pulse present are obtained. The data obtained from these measurements must then be post-processed to determine true RMS average power levels. The post-processing of the data can be performed manually or with the aid of appropriate software.

d. On any frequency or frequencies below or equal to 960 MHz, the field strength shall be measured with equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified.

e. In the frequency bands 1164-1240 MHz and 1559-1610 MHz, average radiated field strength measurements shall be made with a resolution bandwidth of no less than 1 kHz, using techniques as described previously for determining true RMS average power levels.

f. Peak radiated emission measurements shall be made using a spectrum analyzer with a 3 MHz resolution bandwidth and no less than a 3 MHz video bandwidth. The analyzer should be used in a maximum-hold trace mode.

The peak power level expressed in a 3 MHz bandwidth and the frequency at which this level was measured shall be reported in the application for certification. A different resolution bandwidth between 1 MHz and 50 MHz may be employed with appropriate changes to the standard. If a resolution bandwidth greater than 3 MHz is employed, a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing must be submitted to the Commission. It is recommended that measurements using a resolution bandwidth greater than 3 MHz be coordinated with the Commission's laboratory staff in advance of the submission for certification.

g. Field strength measurements may be performed without the use of a ground plane; however, a factor of 4.7 dB must be added to the measurement results thus obtained.

h. To the extent practicable, the device under test should be measured at the distance specified in the appropriate section of this Annex. However, in order to obtain an adequate signal-to-noise ratio in the measurement system, radiated measurements may have to be made at distances less than specified. In these cases, measurements may be performed at a distance other than what is specified, provided: measurements are not made in the near field of the measurement or device under test antenna, except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and, it can be demonstrated that the signal levels necessitated a measurement at the distance employed in order to be accurately detected by the measurement equipment.

i. To the maximum extent possible, field strength measurements should be performed with the equipment under test positioned as it is intended to be used in actual operating conditions.

j. Radiated field strength measurements must be made using the antenna to be employed with the UWB device under test. The measurement antenna must be sufficiently broad band to cover the frequency range of the measurements, and the use of multiple measurement antennas may be required. All measurement antennas used must be accurately calibrated and must demonstrate low phase dispersion over the frequency range of measurement. The orientation of the measurement antenna shall be varied to determine the polarization that maximizes the measured field strength.

k. The spectrum to be investigated should include at least the fundamental emission and the secondary lobe regardless of the center frequency. In order to accomplish this, the frequency spectrum shall be investigated from the lowest frequency generated within the device, without going below 9 kHz, up to the frequency range shown in Section K.1.6 of this Annex. up to an upper frequency defined by adding three divided by the pulse width in seconds to the center frequency in Hz, whichever is greater. The frequency range in Section K.1.6 is based on the center frequency unless a higher frequency, e.g., a carrier frequency, is generated within the device. There is no requirement to measure emissions beyond 40 GHz provided the center frequency is less than 10 GHz; beyond 100 GHz if the center frequency is at or above 10 GHz and below 30 GHz; or beyond 200 GHz if the center frequency is at or above 30 GHz.

## K.4 CONVERSION FORMULAS

To convert from EIRP (i.e., product of the power supplied to the antenna and the antenna gain) values to field strength use the formula:

$$E = \frac{(30 \times P_t \times G_t)^{1/2}}{R}$$

where:

*E* = Field Strength, V/m

*P* = Power supplied to the antenna, watts

*G* = Numerical antenna gain ratio relative to isotropic at the given frequency

*R* = Distance, meters

This formula assumes wave spreading (i.e., "free-space") losses only.

The power supplied to the antenna is the transmitter output power less any line losses. In most cases, the line losses for these devices are difficult to quantify.

Example: Determine if a field disturbance sensor operating at a frequency of 915 MHz with a power output of



1 mW, no line losses and an antenna gain of 3 dBi meets the field strength criterion in Section K.3.5.16 of this Annex.

Step 1: Convert the decibel antenna gain to a numerical ratio.

$$\begin{aligned}\text{Numerical gain ratio} &= 10 (\text{decibel value}/10) \\ &= 10 (3/10) \\ &= 2\end{aligned}$$

Step 2: Use the EIRP to field intensity conversion formula.

$$E = \frac{(30 \times 0.001 \times 2)^{1/2}}{3}$$

$$E = 0.0816 \text{ V/m} = 81,600 \text{ } \mu\text{V/m}$$

Since the criterion is 500,000  $\mu\text{V/m}$  at 3m, the device meets the indicated criterion in Section K.3.5.16 and can be operated without further authority from the Assistant Secretary as indicated in Section 7.9 of this manual.

## K.5 CROSS-REFERENCE OF NON-LICENSE DEVICE STANDARDS IN ANNEX K AND THOSE IN THE FCC CFR 47 PART 15.

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## **Annex L**

### **Freely Associated States**

#### **L.1 INTRODUCTION**

1. In 1947, the United Nations assigned the U.S. administering authority over the Trust Territory of the Pacific Islands, including what is now the Federated States of Micronesia (FSM), the Republic of the Marshall Islands (RMI), and the Republic of Palau (ROP), which the U.S. forces had liberated from the Japanese shortly before the end of World War II.

2. The U.S. concluded Compacts of Free Association with the Governments of the FSM and the RMI in 1982 and 1983, respectively. Following approval by plebiscites of those island nations, the Compacts were approved in the U.S. by Public Law 99-239 (“Compacts”) and entered into force in 1986. A similar Compact was concluded with the ROP and approved by the U.S. in 1986. The Palau Compact entered into force in October 1994. All three Compacts give the U.S. full authority and responsibility for security and defense matters in or relating to each of these countries.

3. The Compacts with FSM and RMI were amended in 2003 after the provisions involving U.S. financial assistance, and certain relevant subsidiary agreements, expired by their terms in 2001. The Compacts, as amended, and their related subsidiary agreements, for the FSM and RMI were approved by Congress through Public Law 108-88, and entered into force in June and May, 2004, respectively. The U.S. and ROP concluded the Palau Compact Review Agreement in 2010 pursuant to a 15-year review mandated by the original Compact. The Review Agreement modifies portions of the Compact, including those relating to telecommunication services provision in Palau. Congress has not yet approved the agreement, so it has not yet entered into force.

4. The Compacts between the U.S. and the FSM, RMI, and ROP are extensive and include provisions on communications and the operation of U.S. telecommunications services in the three states. There are subsidiary agreements that establish the respective governments’ authorities and responsibilities under the relevant provisions of all three Compacts. Two relevant provisions in the amended subsidiary agreements with FSM and RMI are (1) each of the parties must designate a “Competent Authority” to carry out the provisions of the telecommunications provisions and will meet at least annually, and (2) a “Joint Telecommunication Board” (JTB), established between the U.S. and each of the parties in the original Compacts to negotiate and harmonize telecommunication operations of the U.S. with the respective Governments, will review changes to the respective telecommunications systems of the parties. The ROP’s amended subsidiary agreement, concluded in 2010 with the review agreement, also includes these provisions.

5. Executive Order 12569 on management of the Compacts gives the Secretary of State the authority and responsibility to ensure the obligations of the U.S. as set forth in the Compacts and their related agreements are carried out. The U.S. Department of State, Office of International Communications and Information Policy, Bureau of Economics and Business Affairs, was designated by the Assistant Secretary of State for East Asian and Pacific Affairs as the U.S. Competent Authority (USCA) under the Compacts to carry out the responsibilities under the related provisions of the Compacts and related subsidiary agreements. Two representatives from the U.S. Government (USG) will carry out the duties of the USCA. A representative from the U.S. Department of State will serve as the lead USG representative, and can be contacted at [USCA@state.gov](mailto:USCA@state.gov). A representative from the U.S. Department of the Interior (DOI) will serve as the primary contact and expert for telecommunications processes and practices, and can be contacted at [USCA@ios.doi.gov](mailto:USCA@ios.doi.gov).

#### **L.2 AUTHORITY FOR USE OF THE RADIO FREQUENCY SPECTRUM**

1. 1. Under the each of the three Compacts, including as amended, the FSM, the RMI, and the ROP have full authority and responsibility to regulate their respective domestic and foreign communications, including use of the radio spectrum. Section 132 of the Compacts, requires the FSM, RMI, and ROP to permit the USG. to operate telecommunications services to the extent necessary to fulfill its obligations under the Compacts. The USG is obliged to coordinate changes to telecommunications facilities and extraordinary activities or exercises to avoid interference.

2. The requirement to coordinate facilities and to avoid radio interference was given a high priority at the first meetings of the JTB, remaining so to this day, resulting in the adoption of policies and procedures for the management and assignment of radio frequency use in the FSM, RMI and ROP. Under these procedures, on behalf of the USCA, the DOI's representative issues frequency authorizations to USG agencies after positive harmonization with the respective governments.

3. The RMI, the FSM, and the ROP administered territories are listed in Sec. G.2 and are shown in Figure 1.

### **L.3 PROCEDURES FOR OBTAINING A FREQUENCY AUTHORIZATION**

1. USG agencies must have positively harmonized and assigned radio frequency assignments prior to any use of the radio frequency spectrum in the FSM, RMI, and ROP.

2. USG agencies must submit all permanent and temporary (exceeding 30 days duration) frequency assignment applications to NTIA no less than 90 days prior to desired date of use. The frequency assignments will be listed in the Government Master File (GMF), except as outlined in below in Section L.3.2.a. Agencies must submit frequency assignment applications using current frequency assignment processes. The assignments are for record keeping purposes only and are not applicable to Federal Government rules, except as outlined in this annex. NTIA will table the proposals to effect coordination under this annex and notify the DOI representative of the applicable records by serial number. Agencies will submit temporary frequency assignment applications for less than 30 days, except those covered under Section L.3.2.a below, to the DOI representative in Spectrum XXI pseudo GMF card format a minimum of 60 days prior to desired use by the requesting agency national level office. The DOI designated individual, acting on behalf of the USCA, will affect the necessary harmonization with the FSM, RMI, or ROP before assigning temporary and permanent frequencies.

a. Any USG operations within a radius of 200 nautical miles of the U.S. Army Kwajalein Atoll, Republic of Marshall Islands, WGS-84 center coordinates of 090240N 1674417E must:

(1) Ensure equipment/systems are in accordance with Section L.4 below.

(2) Have frequency proposals must be submitted at least 90 days prior to the date of use to the Frequency Manager U.S. Army Garrison Kwajalein Atoll (USAGKA) who will determine if the requirement is supportable and will not interfere with on-going approved testing.

(a.) If the requirement can be met using existing harmonized frequency band assignments, the USAGKA Frequency Manager will subassign the required frequencies to the requestor. No notification to the USCA or NTIA is required.

(b.) If requirements cannot be met by existing band assignments and the requested spectrum is clear to support requested operations, the USAGKA frequency manager will provide the requestor with confirmation of availability of spectrum. The requesting entity will then request positive harmonization as specified in paragraph L.3.2 above.

b. There is no agreement or process to harmonize classified frequency proposals with any of the Freely Associated States. Any classified requirements must be sanitized to the Controlled Unclassified Information level and be releasable to foreign nationals.

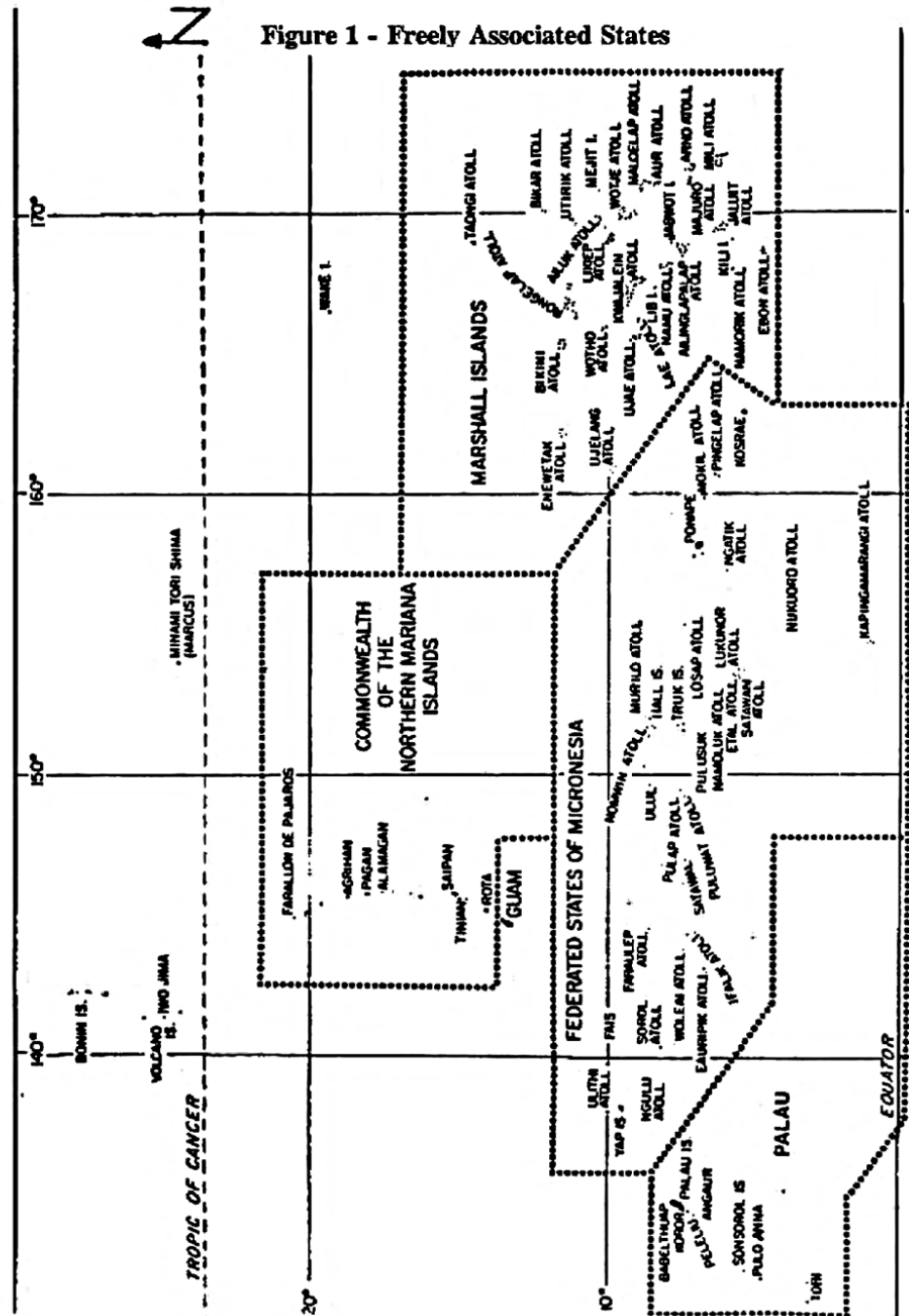
c. A matrix of who to submit proposals to is provided below:

	<b>U.S. Embassy</b>	<b>USAGKA</b>	<b>NTIA</b>	<b>USCA</b>
Duration 30 days or longer			✓	✓
Duration less than 30 days				✓
Ship Visit Duration less than 30 days	✓			
Ship Visit Duration more than 30 days			✓	✓
Within 200 NM of USAGKA and locally supportable		✓		
Within 200 NM of USAGKA and NOT locally supportable; follow above guidance		✓	✓	✓

3. Agencies are encouraged to coordinate both temporary and permanent frequency proposals prior to formal submission and may contact the DOI representative at the following email address: [USCA@ios.doi.gov](mailto:USCA@ios.doi.gov).

## L.4 REQUIREMENT FOR COMMUNICATIONS SYSTEMS CERTIFICATION

SG agencies planning to use radio frequency telecommunication systems in the FSM, RMI, or ROP must ensure these systems have been certified for use by a cognizant certification body, such as FCC, TUV, EC, or NTIA SPS. In the case of Department of Defense (DOD) systems produced or acquired external to the U.S. and its territories the DoD J/F-12 process may be used.



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## **Annex M**

### **Measurement Methods**

#### **M.1 GENERAL**

##### **M.1.1 Introduction**

Chapter 5 of this Manual contains Radio Frequency Spectrum Standards applicable to federal radio stations and systems. This Annex supplements Chapter 5 with the measurement methods appropriately referenced from the various sections of Chapter 5. A measurement method, in turn, is referenced back to Chapter 5. Cross-references to the FCC 47 CFR fixed and/or other measurement method procedures are also provided in this annex. It consists of two sections, one for measuring systems to NTIA and other relevant standards, and the other section to provide guidance on measurement procedures for interference investigations.

##### **M.1.2 Measurement Methods**

Measurement methods included or referenced in this annex are provided only for clarification and uniform interpretation of the standards. In cases of harmful interference, the agencies involved are expected to utilize these or equivalent, mutually agreed upon, methods of measurement for resolution of any disagreement concerning compliance with the standards. Agencies may, at their discretion, use these measurement methods as minimum qualification test procedures, e.g., as part of factory test procedures.

##### **M.1.3 Resolution Bandwidth**

Resolution bandwidth is the 3 dB bandwidth of the measurement system used, e.g., in power spectral density measurements. The appropriate resolution bandwidth of the measurement system varies depending on the modulation type and frequency band but should not be greater than the necessary bandwidth of the transmitter being measured.

#### **M.2 MEASUREMENT METHODS**

##### **M.2.1 Fixed and Mobile Services**

###### **M.2.1.1 Fixed and Mobile Single Sideband and Independent Sideband Equipment (2-29.7 MHz)**

This measurement method is referenced from Section 5.3.1. For HF single sideband transmitters, the transmitter without a device to limit modulation or peak envelope power shall be modulated as follows. The input level of the modulating signal shall be that necessary to produce rated peak envelope power. HF single sideband transmitters in A3A or A3J emission modes shall be modulated by two tones at frequencies on 400 Hz and 1800 Hz (for 3.0 kHz authorized bandwidth), applied simultaneously. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude and 3 dB below the maximum received signal level (RSL) as indicated in Figure 5.3.1 of Chapter 5. The plot of the spectrum shall have a span of 21.1 kHz or that necessary to identify intermodulation products up through the 13th and a resolution bandwidth of 100 Hz. This measurement method is also contained in Title 47 CFR Section 2.1049 (d)(2).

###### **M.2.1.2 Maritime Mobile, FM Operation (150.8 - 162.0125 MHz)**

This measurement method is referenced from Section 5.2.1, see Note (q). The measurement method for frequency tolerances to be used is as given in the Electronic Industries Association (EIA) Standard TIA/EIA-603, Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-E(2016), Chapters 2, 3 and 4, or equivalent

### **M.2.1.3 Fixed Services (406.1 - 420 MHz, 932 - 935/941 - 944 MHz, and 1.71 - 15.35 GHz)**

1. Transmitter Standards
  - a. Measurement Method for Frequency Tolerance of Transmitter (referenced from Section 5.2.1, see Note (u)): A sample of the unmodulated carrier at the center frequency should be measured with equipment having an accuracy of at least five times that of the minimum to be measured.
  - b. Measurement Method for Unwanted Emissions of Transmitters Employing Digital Modulation Techniques (referenced from Section 5.5.3): A sample of the transmitter output at the interface point with the antenna transmission line shall be measured using a measurement system with 4 kHz resolution bandwidth. The full unmodulated carrier power output is used as the transmitter average output reference.
  - c. Measurement of the unwanted emissions shall be made from the lowest radio frequency generated by the equipment to the third harmonic of the carrier with the transmitter modulated as follows:
    - (1) Analog-white noise generator in accordance with EIA RS-252A recommended loading levels.
    - (2) Digital-pseudorandom code generator with appropriate loading levels and format.
2. Receiver Standards
  - a. Receiver Unwanted Signals Measurement Method, (referenced from Section 5.3.3): Couple two signal generators to the input of the receiver and connect a spectrum analyzer to the baseband output. The unmodulated output of one signal generator (desired signal) on the assigned frequency shall be adjusted to reduce the baseband noise by 3 dB as observed on the spectrum analyzer. The unmodulated output of the second signal generator (unwanted signals) shall be adjusted to 70 dB above that of the desired signal. The output frequency of the unwanted signals shall be varied over a range of  $\pm 1$  percent of the assigned frequency excluding frequencies within the receiver 60 dB selectivity bandwidth.
  - b. At each receiver response of the unwanted frequency, adjust the output of the unwanted signal generator for a 3 dB reduction in baseband noise. The difference, expressed in dB, in the output levels of the two signal generators is the unwanted signal attenuation.

### **M.2.1.4 Land Mobile, Single Channel Narrowband Operations (220 - 222 MHz)**

1. This measurement method is referenced from 5.3.4. A sample of the unmodulated carrier at the center frequency should be measured with equipment having an accuracy of at least five times that of the minimum to be measured.
2. Measurement Method for Resolution Bandwidth. The resolution bandwidth of the instrumentation used to measure the emission power shall be 100 Hz for measuring emissions up to and including 250 kHz from the edge of the authorized bandwidth, and 10 kHz for measuring emissions more than 250 kHz from the edge of the authorized bandwidth. If a video filter is used, its bandwidth shall not be less than the resolution bandwidth. The power level of the highest emission within the channel to which the attenuation is referenced shall be remeasured for each change in resolution bandwidth.
3. Additional guidelines may be obtained from the latest revision of Electronic Industries Association (EIA) TSB-57, Sideband Spectrum Measurement Procedure for Transmitters Intended for Use in the 220-222 MHz Band. Modulation is referenced to FCC regulations (CFR 47 2.1047).

### **M.2.1.5 Analog or Digital FM/PM Operations**

1. Wideband (29.7 - 50, 162 - 174, and 406.1 - 420 MHz)
  - a. Measurement Methods for Transmitter Frequency Deviation and Receiver Conducted Spurious Emissions, All Station Classes and Bands, (referenced from Section 5.3.6): The prescribed measurement methods to be used are given in the latest revision of Electronic Industries Association (EIA) Standard TIA/EIA-603, Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-E/(2016), Chapters 2, 3 and 4.

The present EIA measurement methods were written for analog systems. Some of these methods are not appropriate for digital systems. Appropriate analog to digital or digital to analog test sets will have to be used.
  - b. Measurement Method for Frequency Tolerance, (referenced from Section 5.2.1, see Note (i)): An unmodulated standard input signal source, adjusted to the standard input frequency as specified in the latest revision of Electronic Industries Association (EIA) Standard RS-204, Minimum Standards for Land Mobile Communications FM or PM Transmitter, 25 - 866 MHz shall be connected to the receiver under test and adjusted for an output of 20



dB above the receiver sensitivity. The center frequency of the IF passband shall be measured with equipment having a degree of accuracy of at least five times the minimum tolerance to be measured.

2. Narrowband (138 - 150.8, 162 - 174, and 406.1 - 420 MHz Bands)

a. Transmitter and Receiver Measurement Methods (referenced from Section 5.3.7): The measurement methods to be used are as given in the Telecommunications Industries Association standard TIA/EIA-603-E(2016) for narrowband analog equipment, and TIA-102.CAAA-E(2016) for narrowband digital equipment. Where these methods are not specified for a particular system type, appropriate test procedures should be applied.

3. Digital 6.25 kHz Channel Equipment in the 406.1-420 MHz band.

a. Transmitter and Receiver Measurement Methods (referenced from Section 5.3.11): The reference level for showing compliance with the equipment emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to ensure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For frequencies more than 50 kHz removed from the edge of the authorized bandwidth a resolution of at least 100 kHz must be used for frequencies below 1000 MHz. Above 1000 MHz the resolution bandwidth of the instrumentation must be at least 1 MHz.

b. The measurement method to be used for the receiver standards are as given in the Telecommunications Industry Association standard TIA-102.CAAA-B for narrowband digital equipment.

c. Where these methods are not specified for a particular system type, appropriate test procedures should be applied.

### **M.2.1.6 Telemetry, Terrestrial Operations (1435-1525, 2200-2290, 2310-2320, 2345-2395, 4400-4940, and 5091-5150 MHz Bands)**

The bandwidth measurements are performed using a spectrum analyzer (or equivalent device) with the following settings: 30-kHz resolution bandwidth, 300-Hz video bandwidth, and no max hold detector or averaging. These settings are different than those in earlier versions of the Telemetry Standards. The settings were changed to get more consistent results across a variety of bit rates, modulation methods, and spectrum analyzers. This measurement method is referenced in Appendix A.5.2 of Chapter 2 in IRIG-106-17.

### **M.2.1.7 Wideband and Narrowband Emission Level and Temporal Measurements in the Navstar Global Positioning System Bands**

1. The wideband and narrowband radiated equivalent isotropically radiated power (EIRP) levels in the 1164-1240 MHz and 1559-1610 MHz frequency bands are to be measured for systems operating in the frequency bands: 390-413 MHz, and 960-1710 MHz. The following guidelines are to be used in measuring the wideband and narrowband EIRP levels:

a. The radiated EIRP levels in these frequency bands are to be measured using a root mean square (RMS) spectrum analyzer detector function.

b. The wideband emission levels are to be measured using a 1 MHz resolution bandwidth.

c. The narrowband emission levels are to be measured using a 1 kHz resolution bandwidth.

d. For the wideband emission measurement, the RMS levels are to be measured using a 2 millisecond averaging time over each 1 MHz segment.

e. The video bandwidth of the spectrum analyzer should not be less than the resolution bandwidth.

f. The measurement system must have a noise floor of approximately -141 dBW as measured in a 1 MHz resolution bandwidth.

2. The following guidelines are to be used in measuring the temporal characteristics of the emissions in the 1164.45-1188.45 MHz, 1215.6-1239.6 MHz, and 1563.42-1587.42 MHz bands:

a. The system under test should be tuned to its assignable channel that is closest to the GPS frequency band under consideration.

b. A time-domain measurement of the waveform envelope in a 20 MHz bandwidth can be measured using an antenna with appropriate gain and frequency response characteristics connected to either a notch filter or a bandstop filter. The filter is connected to a low noise amplifier (LNA) that operates across the frequency range of

at least 1100-1600 MHz. The LNA is connected to a vector signal analyzer (VSA).

c. Tune the VSA sequentially to the 1164.45-1188.45 MHz, 1215.6-1239.6 MHz, and 1563.42-1587.42 MHz bands and perform time-domain measurements using the full VSA bandwidth of 36 MHz.

d. Subsequent to the data capture, the time-domain waveform envelopes are processed in a 20 MHz bandwidth.

e. Alternative techniques to perform these measurements should be provided to NTIA for review.

## **M.2.2 Radar Spectrum Engineering Criteria (RSEC)**

### **M.2.2.1 General including RSEC-A**

This measurement method is referenced from Section 5.5.1. NTIA Technical Report TR-05-420 titled “*Measurement procedures for the radar spectrum engineering criteria (RSEC)*” should be used for radar emission measurements by federal agencies or other parties seeking system certification by NTIA. It describes techniques for measuring radar spectrum-related parameters and characteristics for compliance with the RSEC. Measurements for both conventional and advanced radar types are addressed. The report can be downloaded at: <http://www.its.blrdoc.gov/publications/2450.aspx>.

### **M.2.2.2 RSEC B**

This measurement method is referenced from Section 5.5.2. In order to coordinate radar operations in the field, an accurate measurement of the operating frequency is necessary. An accuracy of 1 ppm is desirable, although, for most radars 100 ppm is adequate. Of comparable importance is the capability to measure pulse rise time and spectrum occupancy. Accordingly, each Federal agency shall have access to the instrumentation necessary to make a frequency measurement to at least 100 ppm to measure time and frequency parameters necessary to determine conformance with these criteria. For fast rise devices, such as magnetrons, measurement equipment resolution bandwidths of at least 50 MHz should be used.

### **M.2.2.3 RSEC C and RSEC D**

This measurement method is referenced from Sections 5.5.3 and 5.5.4. In order to coordinate radar operations in the field, an accurate measurement of the operating frequency is necessary. An accuracy of 100 ppm is adequate. Of comparable importance is the capability to measure pulse rise time and spectrum occupancy.

Accordingly, each federal agency shall have access to the instrumentation necessary to make a frequency measurement to at least 100 ppm to measure time and frequency parameters necessary to determine conformance with these criteria. For fast rise devices, such as magnetrons, measurement equipment with resolution bandwidths of at least 50 MHz should be used.

### **M.2.2.4 RSEC E**

This measurement method is referenced from Section 5.5.5. In order to coordinate radar operations in the field, an accurate measurement of the operating frequency is necessary. An accuracy of 1 ppm is adequate. Of comparable importance is the capability to measure pulse rise time and spectrum occupancy. Accordingly, each federal agency shall use the measurement equipment necessary to make a frequency measurement to at least 1 ppm and be able to measure time and frequency parameters necessary to determine conformance with these criteria. Measurement equipment shall have resolution bandwidths of at least 10 kHz to measure close in bandwidth limits, and otherwise 100 kHz bandwidth below 1 GHz and 1 MHz bandwidth at and above 1 GHz should be used.

## **M.2.3 Measurement Methods for Interference Investigations**

NTIA has a long history of performing investigations of interference both to and from federal systems, including radars, satellite, and land mobile systems. Many of the investigations have included both on-site investigations and later field and laboratory tests. The investigations have often been performed by combined teams from the Office of Spectrum Management (OSM) working with engineers at the Institute for Telecommunication Sciences (ITS) and

the FCC Enforcement Bureau. They typically begin their work with a detailed review of pertinent GMF records, system certification documents, FAS and IRAC documents. Then they follow up with field work. ITS uses ITS their test and measurement equipment to document and record necessary data and draw conclusions. Using the past interference investigations as examples, NTIA has developed general guidelines, methods, and procedures that agencies can use on their own to assist NTIA on new and future cases. The following steps, with additional details, can be used by the agencies to accomplish that task. If more information or guidance is required on methods and procedures for interference investigations, agencies should contact The Office of Spectrum Management.

The following steps addresses the series of events that need to be done to investigate and resolve, and hopefully mitigate the interference problem. The steps are as follows:

### **Step 1 Gather information about the interference event**

The first step is to gather information and data about the interference problem, and make some sort of initial report. It should give a good description of the problem along with how the data was obtained, who obtained it, and when/where it was gathered. This could be a written report of some sort, phone calls, emails, spectrum analyzer recordings, or other form of media. Many times the reports are taken at the field levels and passed up the agency's command chain, so that the person giving the information to NTIA in the IRAC or TSC is not the person that did the investigation or obtained the field level data.

NTIA has developed as PDF form that agencies can use to fill out and send back to NTIA with fields that allow them to fully document the interference problem. The agencies should use the interference form as best they can to provide when the event, noting how often it happens, what system is being affected, how it affects mission objectives and other fields. It can be helpful if NTIA and ITS engineers talk directly to the field office personnel about the interference problem, so details about the situation are not lost in translation. Of course this is only with the agency's permission to contact the field level engineers. Section 8.2.30 of the NTIA Manual provides guidance on the use of the interference reporting form and how to submit it to NTIA.

Gathering information from industry can also be important since key data parts of their systems are not published or available from the FCC. Typically, OSM management contacts the public affairs or government liaison office about any interference problems and then they in turn will supply local contact names and phone numbers of the right personnel to work with.

### **Step 2 Review the data and meet with agencies to discuss their findings**

In Step 2 a thorough review of the information and data obtained by the agencies by NTIA and ITS personnel, including management and technical review is performed prior to deploying a team for field investigations. If not taken properly or if misinterpreted, the data obtained by the agencies can lead to the wrong conclusions and the wrong decisions. This is especially true when a new type of interference problem arises. In some cases the initial spectrum analyzer recordings of the interference and misinterpreted the problem as being due to other federal systems and it had also misidentified the interference mechanism, which led to more confusion. The best approach is for field engineers to review and discuss the material, make notes or develop questions, and then meet face to face with NTIA or industry representatives to discuss the issues. They can also read through the various reports that NTIA and ITS have published that cover the gamut of federal systems and the types of interference events that they document.

### **Step 3 Review GMF assignments, system certification files and Initial analyses**

When interference problems arise, especially in federal bands, the first thought should be to review the GMF assignments for that band for possible interference sources. A GMF cull needs to be done within some radius of the interference location to obtain the names of the systems and their assignment serial numbers that might be the source of the interference. For fixed terrestrial systems, the radius cull should be within the radio horizon as determined by the antenna height above ground; for airborne systems and terrestrial mobile systems, the area should be at least as large as the operating area. Once all the systems with assigned frequencies are identified, they need to be carefully

reviewed to see if they might be a problem or have been a problem in the past. This would entail reviewing the transmitter power levels of suspect systems and any relevant notes for that assignment such as operating hours/locations and perhaps antenna sector blanking.

If the in-band cull yields no results for a possible source of interference, then the systems in the adjacent bands need to be researched as well, which may or may not include non-federal bands or shared bands. If the adjacent band is non-federal, then it can be problem identifying the tower sites or transmitters as the FCC does not require them to be listed in their license grants that are available online. At that point, the FCC is consulted to see what entities have licenses in the band of interest and the investigation progresses from there. Another consideration is the harmonics of another system causing the interference. A harmonic analyses is much more involved, but can be done by very carefully noting the exact frequency the interference appears on, and then reviewing the GMF assignments in lower bands for a multiplication factor of 2 or 3 that might occur on the channel getting the interference.

#### **Step 4 Perform on-site investigations**

The onsite investigation is crucial. If possible, the best procedure is to follow the interference signal in the victim receiver through its entire chain. That means taking spectrum analyzer measurements in the time and frequency domains of the interfering signal after the antenna, LNA, RF filter and finally the IF filter, before the signal goes to the detector or digitizer. It is also a good idea to do a spectrum survey of the environment to see what signals are present and their location in relationship to the system getting interference. This technique can be used to pinpoint the interference sources and save time during the field investigation. If possible the system's own antenna can be used to help find the azimuth or direction the interference is coming from.

Taking the measurements at these locations in the time and frequency domains lets the engineers see in detail the interference signal's true nature. Is it from receiver front-end saturation, or perhaps a small signal effect or an intermodulation problem? In many cases the experience of the engineer on-site is a key element of the investigation. In previous investigations, ITS engineers recorded the time domain signals of the interfering signal as part of their on-site work, and once they looked at them on a plot, it was easily identified them as a broadband OFDM signals, because they had measured them at the ITS laboratory for previous tasks.

On-site investigations need to be done in an expedited manner. Many times the federal agency uses the system to complete their mission objectives. The system must be taken out of the network and off-line while ITS engineers perform the investigation and do tests. Afterwards, the system must be re-certified for operations before rejoining the network. This is especially true in the case of the weather and air surveillance radar systems. In the case of a non-federal system being involved, removing a tower from a broadband network costs lost revenue and perhaps angry customers wondering why their phone is not working. So the on-site work must be planned out with clear objectives in mind to minimize the down time. Often time it must be done late at night once air traffic has ceased operations and broadband traffic is lower as well.

#### **Step 5 Consult with industry (if required)**

For interference cases that involve non-federal entities, industry representatives need to be involved in the process as soon as it is apparent that the interference is not just between federal systems. It is important to use industry expertise regarding its own systems. Typically this involves meeting with management of the company and then getting the contacts in the local area where the problem exists. NTIA used this approach in past investigations that involved Broadband providers as their management was first contacted about the potential problem and then ITS and SEAD engineers worked with the local network operators in to perform the initial measurement and verify that the macro base stations were indeed the cause of the problem. It was crucial to resolving the matter that the service provider's own engineers verified the problem and could tell their management that the problem was real and it was from their system. When Industry is a part of the whole process it is more cooperative.

#### **Step 6 Identify the interference mechanism and the mitigation path**

There are many kinds of RF interference; before a mitigation solution can be identified, you first have to be able

to identify the type of interference. The various types of interference can generally be grouped into three categories: High-power effects, small-signal effects, and non-linear effects. Once all of the data has been gathered by ITS and NTIA and the Federal agency, it needs to be carefully reviewed so that the correct mechanism is identified. Mistakes can lead to more confusion and a wrong (and therefore ineffective) interference mitigation option being chosen. A brief discussion of each type of interference is discussed and mitigation options are provided.

## **High-Power effect**

In a high-power effect, the interfering signal is strong enough to either burn out the components in the receiver or at the least cause a receiver LNA to saturate and/or ring causing system performance degradation or unavailability. This type of interference has been documented many times before as being a problem both to and from federal systems. It can be mitigated by reducing the power levels of the incoming interfering signal, with filter on the receiver input, to a level where the LNA does not get saturate. That exact level is not always known and it may take experimentation in the laboratory or field to obtain it. Note that care must be taken in how these solutions are used. For example in a radar receiver, initially its front end was configured with (in order): antenna, limiter, bandpass filter and amplifier. This configuration produced interference via the limiter-filter interface. But when the order of the limiter and bandpass filter was reversed (the front end order of components then being antenna, bandpass filter, limiter and amplifier) the problem ceased.

## **Small-Signal effect**

In a small-signal effect the interfering signal is *not strong enough* to cause the receiver's LNA to go into gain compression, but it's strong enough so that the receiver's bit error rate, block rate, probability of target detection is reduced or some other performance metric is negatively affected. It may be reduced below some specified level of performance. It can be mitigated by adding frequency separation between the interferer and the receiver or additional filtering on the transmitter's emissions. Other options are to change the antenna orientations such that the antenna patterns of the systems (the victim and/or the interferer) are used to reduce the interference power. Many times, more than one mitigation option can be used at the same time so that extremes are not needed in any one solution to get rid of the interference. A combination of off-tuning, increasing horizontal and/or vertical antenna separation, and antenna downtilt can be used to mitigate interference. The effectiveness of these methods can be obtained either through field trials and/or simulations.

## **Non-Linear Effects**

In a non-linear effect, the interference causes an intermodulation effect in the receiver or a nearby structure. An intermodulation is the result of two or more signals mixing in the receiver, such that another signal is generated that causes the system to lose capacity or become inoperable. These types of signals are difficult to diagnose and define. The best way is to first do an analysis of the signals in the area, via a GMF search, to see if any combination of them added and subtracted might place a signal on a desired channel. Computer programs are available that will produce the various orders of the intermodulation frequencies given a set of input frequencies. In some cases, by reducing the power of one of the signals with an attenuator or some other means, the intermodulation effect will go away, as it's a function of the multiplication of the power.

For non-linear effects that are not generated in the receiver, but nearby from some structure, is an effect called rusty bolts. The only way to mitigate this type of interference is to move at least one of the systems off the frequency that is getting the interference or reduce the power of them such that the intermodulation no longer occurs. Finally if one of them is simply turned off, the problem will go away, such as the case of a federal earth station receiver that was getting a rusty bolts effect from a nearby tower that was generating a signal from being illuminated by a local TV station's tower. When the analog TV station ceased transmitting and transitioned to a digital signal on another frequency, the interference ceased.

## **Step 7 Post analyses of interference**

The post analyses address what OSM and ITS management and engineers do after the interference problem has

been investigated on-site and after the initial analyses had been completed. The post analyses uses the data that was gathered in the field or laboratory work to develop a mitigation solution after the interference mechanism was identified. This could be a number of things, from making a computer model to develop frequency and distance separation curves to developing the specifications of a filter, or using other techniques as well. It might also include developing exclusion zones or antenna sector blanking.

Post analyses can also show that a regulatory change is required at times when the technical options can't solve all of the problems. For systems that use cognizant behavior to detect and avoid federal systems, a thorough review of the test certification waveforms may be warranted and changes might have to be made to them. Regulatory solutions can take a long time to be set in place as they must go through technical review and consultation with industry before the FCC can change its rules.

## **Step 8 Resolution of Interference**

The resolution addresses how the interference investigation was solved and tells which steps were taken to mitigate the interference. The goal of any interference case is to resolve it in some manner, to either show that it was real or not, and if it was to do something that is acceptable to all parties. The resolution can be a technical solution, administrative/regulatory, or political. In some cases it can be a combination of all three approaches.

**(Last Page in Annex M)**

## **Annex N**

### **Special Considerations for Federal Travelers Information Stations Operating on 1610 kHz**

#### **FEDERAL TRAVELERS INFORMATION STATIONS (TIS) OPERATING ON 1610 kHz**

1. This annex provides regulations and guidance concerning existing and future assignment and protection of Federal Travelers Information Stations (TIS) operating on 1610 kHz. The information contained herein has been extracted from the FCC Memorandum Opinion and Order, FCC 95-385, "Reconsideration of Implementation of the AM Expanded Band Allotment Plan," adopted September 1, 1995, as agreed upon by the NTIA and FCC.

2. Three international agreements (Region 2, Canadian, and Mexican) affect the allotment of expanded band stations. FCC Rules (see 47 CFR) state that the Commission will not make any assignment that does not conform to international requirements and restrictions on spectrum use. Therefore, in the United States-Canadian and United States-Mexican border areas, the 1610 kHz frequency may not be available for Federal TIS operations in order to fulfill the United States' obligations pursuant to agreements with Canada and Mexico. In South Florida, Puerto Rico and the U.S. Virgin Islands, frequency allotments are restricted to those specified in the Region 2 treaty covering the expanded AM Band and stations in those regions will only be assigned on the frequencies permitted by the treaty.

3. Existing federal travelers information stations operating on 1610 kHz have co-primary status with expanded band allotments. Therefore, federal travelers information stations authorized as of August 4, 1994, preclude subsequent assignment for conflicting allotments.

4. The following federal travelers information station criteria, which were agreed upon between the Commission and NTIA, will be used:

a. All projections are based on the daytime operation of the expanded band station assuming Model I facilities. FCC Rules (see 47 CFR) define Model I facilities as a ninety electrical degree (90E) antenna height and ground system and an antenna input power of ten kilowatts daytime and one kilowatt night-time. Daytime, a Model I facility will produce an unattenuated inverse distance field of 971 mV/m at 1 kilometer.

b. Soil conductivities will be taken from Figure M3 of the Commission's Rules notwithstanding the fact that FCC Rules elsewhere specify the use of the measured 0.5 mV/m contour in determining the minimum spacing for a federal travelers information station from a broadcast facility. This is consistent with all other computations made in the allotment process and follows the procedures illustrated in the calculation of the sample allotment plan. Furthermore, this ground conductivity data base produces the needed certainty in the allotment plan and can be used to immediately implement the expanded band.

c. Federal travelers information station protection will be defined by the distance between the expanded band and federal travelers information station transmitter. For co-channel and first adjacent channel projections, we will use the following distances: distance to the expanded band station's 0.5 mV/m contour plus 130 km for co-channel; distance to the 0.5 mV/m contour +15 km for first adjacent channel.

d. Because FCC Rules (see 47CFR) discuss second and third adjacent channel protection of broadcast stations by federal travelers information stations, but does not establish standards, standard broadcast engineering procedure will be followed which specifies that second adjacent channels may have no overlap of the 5 mV/m contours and third adjacent channels may have no overlap of the 25 mV/m contours. Since federal travelers information stations are low power with the 25 mV/m and 5 mV/m contours being close to the federal travelers information station site, we will not permit the proposed expanded band 5 mV/m contour to encompass the federal travelers information station site for second adjacent channel allotments (1630 kHz). Third adjacent channel protection (1640 kHz) is provided if the expanded band station's 25 mV/m contour will not encompass the federal travelers information station site.

5. Existing stations operating on 810, 820, 830, 840 and 850 kHz have the potential to cause interference to stations operating at twice their carrier frequencies, i.e., 1620, 1640, 1660, 1680 and 1700 kHz. Under FCC Rules (see 47CFR) two stations, one with a frequency twice of the other should not be assigned in the same groundwave service area unless special precautions are taken to avoid interference from the second harmonic of the station operating on the lower frequency. The service area of a station is that area protected from interference, and is defined as the 0.5 mV/m for rural areas in Section 73.182(d) of the rules. An expanded band allotment will be precluded if the service area of an existing station operating on 810 to 850 kHz would overlap the service area of a potential

expanded band station operating with Model I facilities as defined in FCC Rules (see 47 CFR). In accordance with prior procedures in this proceeding, the service area will be calculated using conductivities taken from Figure M3 of the FCC Rules (see 47 CFR).

6. Allotments will not be proposed that do not maintain co-channel, first and second adjacent channel spacing in accordance with the minimum spacing requirements from existing station operations on 1580, 1590, and 1600 kHz.

**(Last Page in Annex N)**



## **Annex O**

### **Procedures and Guidance Related to the Spectrum Relocation Fund and Transition Activities in Support of Relocation or Sharing by Federal Government Stations**

#### **O.1 INTRODUCTION**

1. Sections 113(g)-(j) and 118 of the National Telecommunications and Information Administration Organization Act (NTIA Organization Act), as amended (47 U.S.C. §§ 923(g)-(j), 928), provide incentives and financial assistance through a Spectrum Relocation Fund (SRF) to facilitate transition activities associated with the relocation of or sharing by eligible federal entities from or in frequency bands that the Federal Communications Commission (FCC) reallocates and auctions. The Office of Management and Budget (OMB) administers the SRF and approves funding levels, timelines, and transfers associated with spectrum relocation and sharing activities.

2. The statute includes provisions addressing the content and format of federal entity transition plans as well as the review of such plans by a Technical Panel established in accordance with 47 CFR § 301.120. Other provisions establish a dispute resolution process, including dispute resolution boards, and ensure the protection of classified and other sensitive information.

##### **O.1.1 Purpose**

1. The purpose of this Annex is to provide guidance to, and establish regulations and requirements for, federal entities that operate authorized Federal Government stations that incur relocation or sharing costs because of planning for an auction or transitioning such frequencies from federal use to exclusive non-federal use or to shared use. Section 113(g)(6) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(6)), requires NTIA to “take such actions as necessary to ensure the timely relocation of federal entities’ spectrum-related operations from [eligible] frequencies . . . to frequencies or facilities of comparable capability and to ensure the timely implementation of arrangements for the sharing of [eligible] frequencies.” This Annex contains information, policies, and procedures applicable to only federal entities and implements the above-referenced statutory provisions with regard to such entities.

2. Other provisions of this Manual, NTIA Reports, OMB guidance, and FCC regulations are relevant and should be consulted by the federal entities. In addition, rules and regulations that implement particular provisions or concern NTIA actions primarily affecting non-federal spectrum users, including regulations governing the workings of the Technical Panel and dispute resolution boards are contained in Section 301 of Title 47 of the Code of Federal Regulations (CFR).

##### **O.1.2 Organization of Annex; Modifications and Supplements**

1. This Annex contains eight sections and one appendix addressing the following topics and subtopics:
  - a. O.1: Introduction
  - b. O.2: Definitions
  - c. O.3: Transition Plan Preparation and Procedures
  - d. O.4: Transition Plan Contents and Common Format
  - e. O.5: Transition Plan Implementation
  - f. O.6: Transfers from Spectrum Relocation Fund
  - g. O.7: Additional Payments for Research and Development and Other Planning Activities
  - h. O.8: Classified and Other Sensitive Information
  - i. Appendix: Common Format for Transition Plans
2. NTIA may modify or supplement this Annex, including the common format and associated templates for transition plans, to reflect band- or service-specific information and guidance for purposes of implementing the NTIA Organization Act, as amended, in connection with subsequent reallocation decisions affecting particular eligible frequencies.

## O.2 DEFINITIONS

This part provides applicable definitions and related terminology used in this Annex and for purposes of the provisions herein. Additional definitions may be found in Chapter 6 of this Manual. A definition followed by a statutory or regulatory reference generally indicates that the definition is set forth in or derived from such reference.

**a. Accelerated Implementation Payments:** Payments from the Spectrum Relocation Fund to eligible federal entities for relocation or sharing costs associated with the implementation of a transition plan and in order to encourage such entities to complete the implementation more quickly, thereby encouraging timely access to the eligible frequencies that are being reallocated for exclusive non-federal use or shared use. (47 U.S.C. § 928(f)(2))

**b. Accelerated Replacement Costs:** The costs associated with the accelerated replacement of systems or equipment if the acceleration is necessary to ensure the timely relocation of systems to a new frequency assignment or geographic location or the timely accommodation of sharing of spectrum with federal users. (47 U.S.C. § 923(g)(3)(A)(v))

**c. Auction:** The competitive bidding process through which licenses are assigned to non-federal users by the FCC under Section 309(j) of the Communications Act of 1934, as amended. (47 U.S.C. § 309(j))

**d. Auction Start Date:** The date specified by the FCC on which an auction of eligible frequencies will commence pursuant to the FCC's notification to NTIA under Section 113 of the NTIA Organization Act, as amended. (47 U.S.C. § 923(g)(4)(A))

**e. Classified Assignment:** Authorization to use a radio frequency and information related to that authorization that a U.S. Government agency has determined pursuant to Executive Order 13526, or any predecessor or successor executive order, requires protection against unauthorized disclosure and that is marked as "confidential," "secret" or "top secret" to indicate its classified status when in documentary form.

**f. Classified Information:** Information that is, for reasons of national security, specifically designated by a United States Government Agency for limited or restricted dissemination or distribution. (18 U.S.C. § 798(b); 47 U.S.C. § 923(h)(7))

**g. Controlled Unclassified Information (CUI):** Information the Government creates or possesses, or that an entity creates or possesses for or on behalf of the Government, that a law, regulation, or Government-wide policy requires or permits an agency to handle using safeguarding or dissemination controls. (32 C.F.R. Part 2002)

**h. Dispute Resolution Board:** A board established, pursuant to Section 113(i) of the NTIA Organization Act, as amended (47 U.S.C. § 923(i)) and governed by Subpart C of Section 301 of Title 47, CFR, to resolve disputes that may arise between federal entities and non-federal users regarding the execution, timing, or cost of transition plans submitted by federal entities.

**i. Eligible Federal Entity:** A federal entity that operates a U.S. Government station that incurs relocation or sharing costs because of planning for an auction of spectrum frequencies or the reallocation of spectrum frequencies from federal use to exclusive non-federal use or to shared use. (47 U.S.C. § 923(g)(1))

**j. Eligible Frequencies:** Any band of frequencies reallocated from federal use to non-federal use or to shared use after January 1, 2003, that is assigned by auction. (47 U.S.C. § 923(g)(2)(B))

**k. FCC:** The Federal Communications Commission

**l. Federal Entity:** Any department, agency, or other instrumentality of the U.S. Government that utilizes a government station assignment obtained under Section 305 of the Communications Act of 1934, as amended. (47 U.S.C. §§ 305, 923(l))

**m. Non-Federal User:** Any FCC licensee authorized to use eligible frequencies or a winning bidder in a FCC auction for eligible frequencies that has fulfilled the FCC's requirements for filing a long-form license application and remitting its final payment. (47 CFR § 301.20)

**n. NTIA:** The National Telecommunications and Information Administration, Department of Commerce. Such term includes the Assistant Secretary of Commerce for Communications and Information.

**o. OMB:** The Office of the Management and Budget, Executive Office of the President

**p. Pre-Auction Planning Costs:** A sub-set of transition costs; specifically relocation or sharing costs associated with research, engineering studies, economic analyses, or other expenses reasonably incurred in connection with: (1) calculating estimated relocation or sharing costs; (2) determining the technical or

operational feasibility of relocation to one or more potential relocation bands; or (3) planning for a relocation or sharing arrangement. (47 U.S.C. § 923(g)(3)(A)(iii))

**q. Sensitive Information:** For purposes of implementing Section 119 of the NTIA Organization Act, as amended (47 U.S.C. § 929), non-classified information for which there is a legal basis for nondisclosure and the public disclosure of which would be detrimental to national security, homeland security, or public safety, or would jeopardize a law enforcement investigation.

**r. Technical Panel:** The panel established by Section 113(h)(3)(A) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(3)(A)) and governed by Subpart B of Section 301 of Title 47, CFR, to review the sufficiency of transition plans.

**s. Transition Costs:** Relocation or sharing costs, or costs incurred by a Federal entity in connection with the auction of spectrum frequencies or the sharing of spectrum frequencies (including the auction or a planned auction of the rights to use spectrum frequencies on a shared basis with such entity) in order to achieve comparable capability of systems as before the relocation or sharing arrangement. Such term includes, with respect to relocation or sharing, as the case may be—

(i) the costs of any modification or replacement of equipment, spares, associated ancillary equipment, software, facilities, operating manuals, training, or compliance with regulations that are attributable to relocation or sharing;

(ii) the costs of all engineering, equipment, software, site acquisition, and construction, as well as any legitimate and prudent transaction expense, including term-limited Federal civil servant and contractor staff necessary to carry out the relocation or sharing activities of a Federal entity, and reasonable additional costs incurred by the Federal entity that are attributable to relocation or sharing, including increased recurring costs associated with the replacement of facilities;

(iii) the costs of research, engineering studies, economic analyses, or other expenses reasonably incurred in connection with—(I) calculating the estimated relocation or sharing costs that are provided to the Commission at least 6 months prior to the commencement of an auction; (II) determining the technical or operational feasibility of relocation to one or more potential relocation bands; or (III) planning for or managing a relocation or sharing arrangement (including spectrum coordination with auction winners);

(iv) the one-time costs of any modification of equipment reasonably necessary—(I) to accommodate non-Federal use of shared frequencies; or (II) in the case of eligible frequencies reallocated for exclusive non-Federal use and assigned through a system of competitive bidding but with respect to which a Federal entity retains primary allocation or protected status for a period of time after the completion of the competitive bidding process, to accommodate shared Federal and non-Federal use of such frequencies for such period; and

(v) the costs associated with the accelerated replacement of systems and equipment if the acceleration is necessary to ensure the timely relocation of systems to a new frequency assignment or the timely accommodation of sharing of Federal frequencies.

**t. Transition Plan:** The plan submitted by a federal entity after announcement of an auction to implement the relocation or sharing arrangement pursuant to Section 113(h)(1) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(1)), and this Annex.

### O.3 TRANSITION PLAN PREPARATION AND PROCEDURES

Section O.3 of this Annex outlines the processes related to preparing, submitting, reviewing, and publishing a federal entity's transition plan. The next Section, O.4, specifies the contents of each transition plan and describes the use of the Spectrum Transition Tool (ST2)<sup>1</sup> to prepare transition plans following a common format. Section O.8 below sets forth regulations to ensure that publicly released transition plans do not contain classified information or other sensitive information.

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<sup>1</sup> ST2 is an information system developed, maintained, and authorized to operate as part of the NTIA Flexible Web Development Platform (NTIA-034). It meets the minimum-security controls for a "Moderate" system as required by Federal Information Processing Standard (FIPS) 200, *Minimum Security Requirements for Federal Information and Information Systems*, and defined by National Institute of Standards and Technology (NIST) Special Publication (SP) 800-53, Revision 4, *Security and Privacy Controls for Federal Information Systems and Organizations*.

### **O.3.1 General**

1. Pursuant to Section 113(g)(4)(A) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(4)(A)), the FCC must notify NTIA at least 18 months prior to auction start date, as defined in Section O.2 of this Annex. NTIA, “on behalf of the Federal entities and after review by the Office of Management and Budget,” must notify the FCC of the estimated costs and timelines for such frequencies at least six months prior to the auction start date. The FCC uses the estimated cost data to establish a reserve price for the auction of eligible frequencies. Pursuant to Section 113(g)(5) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(5)), NTIA shall at the time of providing the initial estimate of costs and timelines to the FCC (i.e., at least six months prior to the auction start date), submit “for approval” a copy of the estimates and timelines to the following: (1) the Committee on Appropriations of the House of Representatives; (2) the Committee on Appropriations of the Senate; (3) the Committee on Energy and Commerce of the House of Representatives; and (4) the Committee on Commerce, Science, and Transportation of the Senate. In addition, NTIA must provide a copy to the Comptroller General, U.S. Government Accountability Office (GAO). “Unless disapproved within 30 days, the estimate shall be approved. If disapproved, the NTIA may resubmit a revised initial estimate.”

2. To receive transfers from the SRF, each eligible federal entity must submit to NTIA and the Technical Panel “a transition plan for the implementation by such entity of the relocation or sharing arrangement.” Any transfer from the SRF to an eligible federal entity is also conditioned by the statute on Technical Panel approval of the transition plan and the publication of the plan, with the exception of classified or other sensitive information, on NTIA’s website.

3. In addition to the 18-month and six-month pre-auction deadlines mentioned above, the statute imposes additional deadlines upon federal entities anticipating transfers from the SRF, on NTIA, and on the Technical Panel. These include the following:

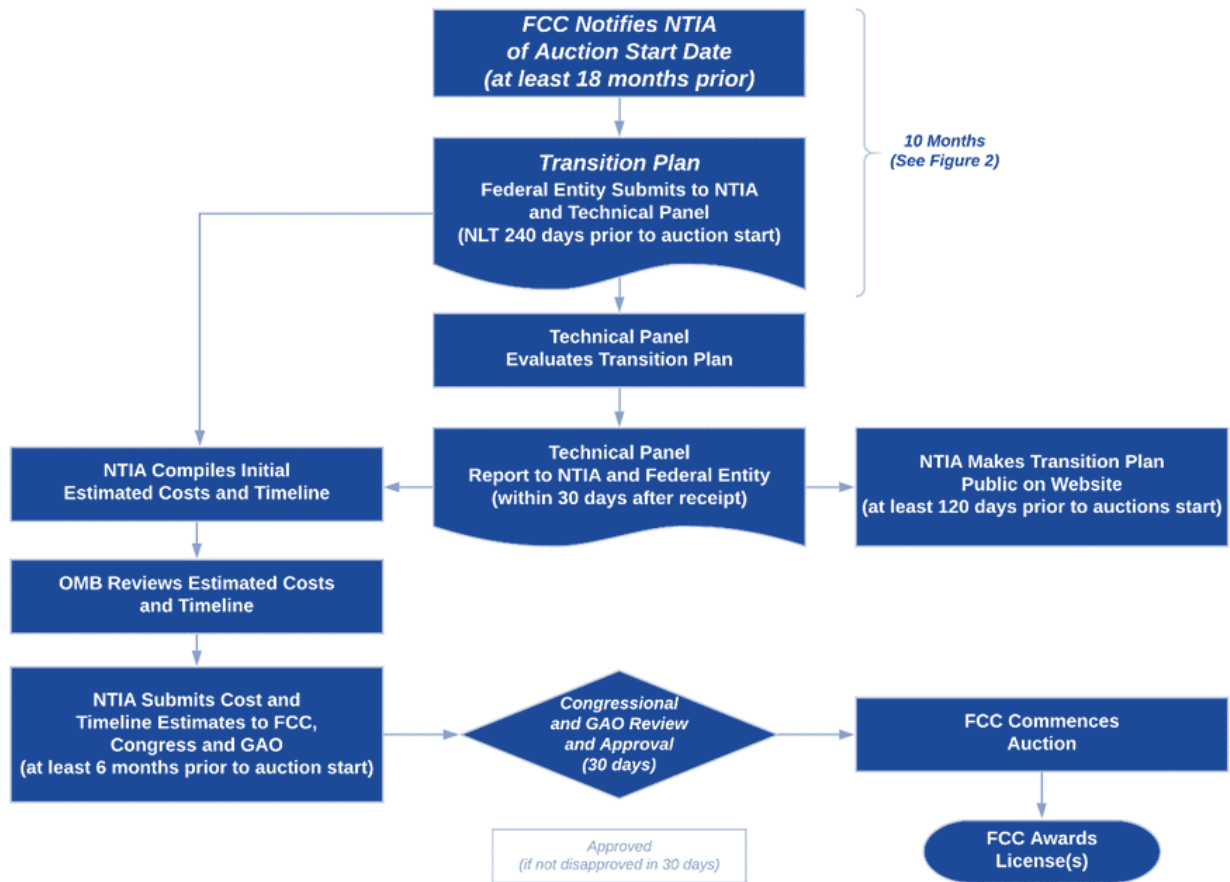
a. a federal entity must submit a transition plan “for the implementation by such entity of the relocation or sharing arrangement” to NTIA and the Technical Panel not later than (NLT) 240 days (i.e., approximately eight months) prior to the auction start date;

b. the Technical Panel must submit to NTIA and to the federal entity a report on the sufficiency of the transition plan NLT 30 days after the submission of the plan (i.e., approximately seven months, or 210 days, prior to the auction start date); and

c. NTIA must make the transition plans, with the exception of classified or other sensitive information, publicly available on its website NLT 120 days (i.e., approximately four months) before the auction start date.

4. If the Technical Panel finds that a federal entity’s plan is “insufficient,” the Technical Panel informs the affected federal entity and such entity must submit a revised plan to the Technical Panel within 90 days (i.e., approximately three months). The Technical Panel would then have another 30 days during which to determine whether the revised plan is sufficient. Figure 1 provides an overview of the transition plan process leading up to the implementation phase that follows the issuance of new licenses by the FCC.

**Figure 1. Transition Planning Process**



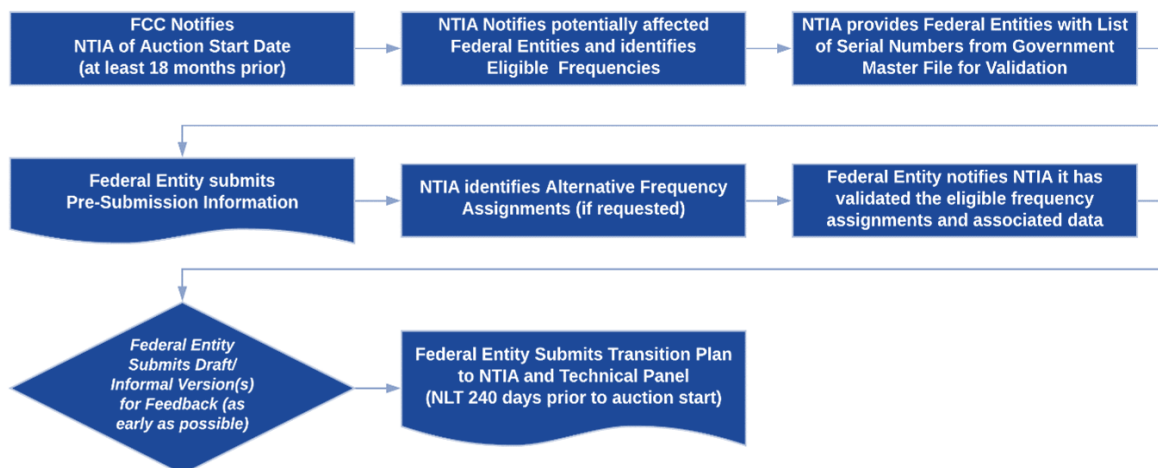
### O.3.2 Preparation of Transition Plans

The following information sets forth general guidance for the preparation of transition plans. NTIA will also provide specific guidelines for each auction and related eligible frequencies with more detail and instruction, as applicable and necessary.

#### O.3.2.1 General Statutory Requirements

Pursuant to the statutory timeframes summarized above, federal entities will normally have approximately ten months to prepare their transition plans for eligible frequencies. During this time, NTIA will take additional steps, as indicated in Figure 2 and outlined below, to help ensure that each initial plan is complete and the federal entities have the information needed to develop timelines and estimated relocation or sharing costs. For example, as required by Section 113(g)(4)(B) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(4)(B)), NTIA will provide requesting federal entities with information regarding alternative frequency assignments from bands previously identified to which the entities' operations could be relocated. In addition, as set forth in the Appendix to this Annex O, NTIA has developed a common format for all federal entities to follow in preparing transition plans pursuant to the statute and under this Annex. NTIA also maintains an automated tool to produce transition plans in the required format.

**Figure 2. Additional Steps during Transition Plan Preparation Period**



#### O.3.2.2 NTIA Notification to Federal Entities; Federal Entity Pre-Submission Information

Upon receipt of the FCC's auction start date notification, NTIA will notify all affected federal entities and the Technical Panel of the auction start date, the deadline for submitting transition plans (i.e., 240 days prior to the auction start date), and the eligible frequencies. This notification will request that any affected federal entity provide to NTIA, within 15 days, certain pre-submission information, including the following: (1) the point of contact information requested in Section O.4.2 of this Annex; (2) whether any of the information required to be included in the transition plan is anticipated to be marked as classified information or CUI; (3) for any information identified under (2), the level of classification and/or the CUI category or subcategories that apply, (4) whether the federal entity, in its transition plan, intends to seek reimbursement from the SRF for pre-auction planning costs; and (5) whether the federal entity will request pre-auction transfers to cover pre-auction planning costs. This information will allow NTIA, the Technical Panel, and OMB to better plan for the receipt and review of such plans and, if necessary, provide supplemental guidance to assist federal entities with preparing their transition plans.

### O.3.2.3 Assignment Data Validation; Alternative Assignments

1. Together with or subsequent to the notification provided under Section O.3.2.2 above, NTIA will provide federal entities a list of eligible frequencies on record in the Government Master File (GMF). To the extent that any of the GMF data related the federal entity's assignments are classified or CUI, only serial numbers will be included in the list, and the classified or CUI data will be handled pursuant to Section O.8 of this Annex. Each federal entity will be asked to validate frequency assignment data that is applicable to its transition plan. The assignment parameters outlined below will be preloaded into the ST2 for eligible frequencies, unless an affected federal entity notifies NTIA in its pre-submission information not to pre-load the assignment data and requests to be provided a full list of the entity's current assignments in the eligible frequencies as contained in the Government Master File (GMF).

2. NTIA will seek to confirm and validate the data elements listed below for current assignments within the eligible frequency band or bands identified in the NTIA notification. Items marked with a + indicate those items that will be pre-loaded into ST2 for validation.

- +SER: Serial Number
- +FRQ/FRB: Frequency(ies)
- +Emission Bandwidth (Necessary Bandwidth) (MHz): Derived from Emission Designator (EMS)
- +XSC: Transmitter State/Country
- +XLA/XLG: Transmitter antenna coordinates
- +RSC: Receiver State/Country
- +RLA/RLG: Receiver antenna coordinates
- Receiver Bandwidth
- Authorized Area of Operations
- System Use

3. Within 30 days of notice that baseline data has been entered into ST2, or after receiving assignment information and instructions, each affected federal entity must validate the data, or submit updated data. Each affected federal entity must also initiate appropriate actions to correct the assignment(s) in the GMF via normal processes and procedures.

4. In addition to the pre-submission information provided under Section O.3.2.2 above and the corrections identified under this section, each affected federal entity may, pursuant to Section 113(g)(4)(B) of the NTIA Organization Act (47 U.S.C. § 923(g)(4)(B)), also include a request for information regarding alternative frequency assignments, specifying the frequency band(s), to which their radio communications operations can be relocated for purposes of calculating the estimated relocation or sharing costs and timelines. Such a request shall be considered "timely" under the statute if it is made to NTIA during the timeframe between notification of the auction start date and 30 days after receiving the assignment data under this section. Ideally, the request should be made at the same time as the pre-submission information is provided.

5. Upon receipt of a federal entity's timely request under the previous paragraph, NTIA will assess the request for alternative assignments and, pursuant to Section 113(g)(4)(C) of the NTIA Organization Act (47 U.S.C. § 923(g)(4)(C)), NTIA will, to the extent practicable and consistent with national security considerations, provide such information based on the geographic location of the federal entities' facilities or systems and the frequency bands used by such facilities or systems. As transition plans are finalized, NTIA will work collaboratively with the federal entities, as required, to establish planning assignments with a special note under Section A.6 of Annex A of this Manual. Once the planning assignment is "activated," or a different alternative frequency is requested and assigned, the special note will be deleted.

6. The data provided to each agency pursuant to Paragraph 1 of this Section may include serial numbers associated with experimental and other TEMPORARY or TRIAL frequency assignments contained in the GMF. Pursuant to Section 6.4 of this Manual, experimental classes of stations operate via temporary assignments and on a secondary basis to stations of all other services. If an agency seeks to convert any such assignments to a REGULAR assignment that supports ongoing operations for an unspecified period of time, the agency must submit an appropriate frequency action before submission of its initial transition plan. If use by the federal entity of the eligible frequencies is authorized by an experimental frequency assignment as of the date of the submission of the initial transition plan, the agency shall enter "NIB" in the "Remarks" field in the transition plan to indicate operations on a "not to interfere"

basis.

### **O.3.3 Informal Reviews and Submission of Initial Transition Plans**

1. Federal entities are encouraged while preparing transition plans to request optional review of draft versions of their transition plans by NTIA and the Technical Panel as early as possible to allow for more adequate time for discussion and feedback in order to mature such plans. As noted above, no later than 30 days from when the plan is formally submitted, the Technical Panel shall submit to NTIA and the federal entity a report on the sufficiency of the transition plan. This 30-day timeframe affords a relatively short period for the Technical Panel to conduct its assessment of the plan, and therefore, in addition to requesting draft plans and providing feedback on those that are substantially complete, NTIA may implement other mechanisms (e.g., memoranda, guidance, workshops, or a “help desk”) to facilitate the timely and successful review of the plan that is formally submitted by each federal entity. An informal review opportunity will assist in the preparation of the transition plan and avoid the potential procedural dilemma presented if and when the Technical Panel concludes that an initial plan is not sufficient.

2. Whether or not a federal entity chooses to seek additional guidance through the submission of a draft plan for an informal review, its initial transition plan must be submitted NLT the deadline specified by the statute and NTIA. NTIA will provide specific instructions for each auction and related eligible frequencies as to the formal submission of initial transition plans.

3. When requesting transfers for any pre-auction costs, the submitter must agree to and state that the transition plan meets the criteria in section 118(d)(3)(B)(ii) of the NTIA Organization Act, as amended (47 U.S.C. § 928(d)(3)(B)(ii)). The submitter must further affirm that the request for transfer of pre-auction costs before the auction will likely allow for timely implementation of relocation or sharing, thereby increasing net expected auction proceeds by an amount not less than the time value of the amount of funds transferred (47 U.S.C. § 928(d)(3)(B)(i)(I)).

4. To the extent that initial transition plans contain classified or other sensitive information, such information will be handled pursuant to Section O.8 of this Annex.

### **O.3.4 Review of Initial Transition Plan**

1. Pursuant to Section 113(h)(3)(D) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(3)(D)), NTIA has adopted regulations that govern the operation of the Technical Panel. The Technical Panel will assess the sufficiency of transition plans and reasonableness of the proposed timelines and estimated relocation or sharing costs, including the costs of any proposed expansion of the capabilities of a federal system in connection with relocation or sharing. During the review process, the Technical Panel or NTIA support staff may identify administrative errors or other modifications that should be made for accuracy before the plan is found sufficient. The federal entity may make these required changes and resubmit a corrected plan to replace the plan under review. This process allows the Technical Panel’s review to continue on schedule without resetting the review timeline.

2. In accordance with Section 113(h)(4)(A) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(4)(A)), as implemented in 47 CFR § 301.120, the Technical Panel shall, within 30 days of the receipt of a federal entity’s Transition Plan, submit to NTIA and to the federal entity the Technical Panel’s report on the sufficiency of the Transition Plan. This report must include: (1) a finding as to whether the federal entity’s Transition Plan includes the information required by the applicable provisions set forth in this Annex O; (2) an assessment of the reasonableness of the proposed timelines contained in the federal entity’s Transition Plan; (3) an assessment of the reasonableness of the estimated relocation or sharing costs itemized in the federal entity’s Transition Plan, including the costs identified by such plan for any proposed expansion of the capabilities of the federal entity’s system; and (4) a conclusion, based on the aforementioned finding and assessments, as to the sufficiency of the Transition Plan.

### **O.3.5 Submission and Review of Revised Transition Plan**

1. In the event the Technical Panel’s initial report concludes that the federal entity’s Transition Plan is insufficient, the report shall also include a description of the specific information or modifications that



are necessary for the federal entity to include in a revised Transition Plan. If the Technical Panel finds the initial plan insufficient, the federal entity shall submit a revised plan not later than 90 days after the submission of the report by the Technical Panel. Not later than 30 days after the receipt of a federal entity's revised Transition Plan submitted after an initial or revised plan was found by the Technical Panel to be insufficient, the Technical Panel must submit to NTIA and to the federal entity the Panel's supplemental report on the sufficiency of the revised Transition Plan. The Technical Panel's supplemental report on the revised Transition Plan shall include: (1) a finding as to whether the federal entity's revised Transition Plan includes the necessary information or modifications identified in the Technical Panel's initial report; (2) a reassessment, if required, of the reasonableness of the proposed timelines contained in the federal entity's revised Transition Plan; (3) a reassessment, if required, of the reasonableness of the estimated relocation or sharing costs itemized in the federal entity's revised Transition Plan; and (4) a conclusion, based on the aforementioned finding and reassessments, as to the sufficiency of the revised Transition Plan.

2. In the event the Technical Panel's report concludes that the federal entity's revised Transition Plan is insufficient, further submissions and reviews shall follow the process and timelines for revised Transition Plans outlined above.

### **O.3.6 Compilation and Notification of Estimated Costs and Timelines**

Concurrent with the review of the initial transition plans by the Technical Panel, NTIA will compile and consolidate the estimated relocation or sharing costs and timelines. Even though one of the members of the Technical Panel is appointed by the Director of OMB, Section 113(g)(4)(A) of the NTIA Organization Act (47 U.S.C. § 923(g)(4)(A)) requires that OMB review the estimated costs and timelines before NTIA, on behalf of the federal entities, notifies the FCC, GAO, and Congress of the estimated costs and timelines. NTIA will provide the necessary and timely information and notifications, after OMB review, to the FCC, GAO, and Congress.

### **O.3.7 Publication of Transition Plans**

Pursuant to Section 113(h)(5) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(5)), "NTIA shall make the transition plan publicly available on its website" ([www.ntia.doc.gov](http://www.ntia.doc.gov)) NLT 120 days before the auction start date. However, in accordance with Section O.8 of this Annex, classified and other sensitive information will be excluded from any plan or other information that is publicly released. In addition, NTIA will only publish those transition plans that have been found to be sufficient by the Technical Panel as well as any updates in accordance with Section O.3.8. NTIA will publish transition plans in file formats that will be determined for each auction.

### **O.3.8 Updates to Transition Plans**

1. Pursuant to Section 113(h)(6) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(6)), as each federal entity implements the transition plan, it shall periodically update the plan to reflect any changed circumstances, including changes in estimated relocation or sharing costs or the transition timeline for relocation or sharing. Updates must be submitted as revisions to the most current approved transition plan in ST2. Unless otherwise advised by NTIA, the federal entity should take the actions specified below, depending on the reason for the update, no later than 30 days after the date on which the changed circumstances materially affecting the transition are discovered, determined or directed.

2. Additional Funds: To identify the need for and request additional funds, federal entities shall submit a formal memorandum signed by the entity head or their designated official to OMB with cc: to NTIA and the FCC. The memorandum shall identify the total amounts requested; a detailed explanation of how the funds will be used; a full justification of why they are required, and a full itemization of the funds already spent. OMB may provide additional guidance and request additional detail, as needed, to assess the request properly.

3. Extension of Transition Timeline: It is important that federal entities transition their use of the auctioned spectrum as originally projected, approved, and made known to the public prior to the auction. Federal entities should take all actions possible to avoid a delayed spectrum transition. However, once there

is clear evidence that the original date cannot be met, but not earlier than 18 months prior to the approved transition timeline, federal entities shall submit a formal memorandum signed by the head of the entity to NTIA with cc: to OMB and FCC. The memorandum shall identify the spectrum and locations affected and provide an explanation of the circumstances, including a detailed explanation of efforts taken to mitigate the problem and meet the original transition timeline. Prior to submitting the memorandum, the federal entity must coordinate with any affected licensees and obtain their concurrence to continued operations, as requested. Continued operations must operate on a non-interference basis (NIB), unless otherwise coordinated with the licensees; and approved by NTIA.

4. Alternate Technical Solution: If a federal entity determines that execution of its original plan for transition is not feasible or determines there is a better solution, it shall submit an updated transition plan to document and obtain approval of its new plan. For an alternate technical solution that does not require additional funds and does not extend an approved transition timeline, the agency shall submit a formal memorandum signed by the agency head or designated official to OMB with cc: to NTIA and FCC requesting approval of the change. The memo should fully explain the original technical solution and justification for the change, including the circumstances that cause it to not be able to be executed as outlined in the approved transition plan or why the new solution is better. Include details about any funds expended to date, the costs associated with the new proposed solution, and an explanation of how the remaining funds will be spent on the new solution.

5. Extension of Spending Timeline: If during the implementation of a transition plan, a federal entity determines that it will need more time to fully expend funds for any of its systems or programs, the federal entity shall advise OMB and NTIA via email. The request should identify the amount of additional time requested and explain the reason the extension is needed. If an extension of the spending timeline is associated with a request for additional funds, it should be included in the memorandum submitted per paragraph 2 of this section.

6. Once a request submitted in accordance with 2-5 above has been approved, and for all other types of updates (*e.g.*, administrative, points of contact), a revision to the most recently approved transition plan must be submitted via ST2. In those special circumstances when use of ST2 is waived, federal entities must provide an updated plan with an additional Tab to the template file that catalogs any changes from the previously approved plan. Pursuant to Section 113(h)(6) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(6)), NTIA will make the updated plan available on its website ([www.ntia.doc.gov](http://www.ntia.doc.gov)), excluding any classified or other sensitive information in accordance with Section O.8 of this Annex.

7. In addition to other changed circumstances and subject to any guidance from OMB, a memorandum to OMB and an updated plan must also be submitted in order to specify requests for transfers associated with accelerated implementation payments from the SRF, as such phrase is defined in Section O.2 of this Annex.

## **O.4 TRANSITION PLAN CONTENTS AND COMMON FORMAT**

1. Pursuant to Section 113(h)(1) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(1)), this Annex specifies the “common format” for transition plans. The NTIA developed ST2 to format information required for inclusion in transition plans into the common format as an exported report. All federal entities shall use ST2 to prepare and submit non-classified transition plans pursuant to the statute and under this Annex, unless a waiver is granted due to special circumstances.

2. Given extenuating circumstance, a federal entity may submit a request for a waiver of the use of ST2 to the NTIA Associate Administrator for Spectrum Management. If granted, NTIA will provide the common format as a standard spreadsheet file for use in completing the transition plan in preparation for the auction of eligible frequencies. The same common format file will be provided to federal entities that identify in their pre-submission information pursuant to O.3.2.2 a need to submit a classified annex or transition plan. Section O.8 sets forth regulations to ensure that publicly released transition plans do not contain classified information or other sensitive information.

3. The previous section of this Annex described the process and procedures for the preparation, review, transmittal and publication of transition plans. This section describes each part of the transition plan common format (see Appendix), including specifics about the content to be entered into ST2 and a description of each section as included in the exported plan. NTIA will provide more specific instructions

as well as direction as to any auction-specific templates changes, for each auction and related eligible frequencies, as required, in the notification outlined in section O.3.2.2.

#### **O.4.1 General**

1. Each transition plan must include the information called for by paragraph (h)(2) of Section 113 of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(2)), as well as other related provisions. In particular, each plan must contain basic operational and technical data, including: (1) the current use by the federal entity of the eligible frequencies to be auctioned; (2) the geographic location or area where the federal entity's facilities or systems are located; and (3) the frequency bands used by such facilities or systems.<sup>2</sup> The plan must also set forth the "steps to be taken by the federal entity to relocate its spectrum use from such frequencies or to share such frequencies, including timelines for specific geographic locations in sufficient detail to indicate when use of such frequencies at such locations will be discontinued by the federal entity or shared between the federal entity and non-federal users."<sup>3</sup>

2. In addition, each transition plan must describe the federal entity's specific plans and timelines for using the amounts from the SRF for procuring, testing, and deploying new equipment and for covering the broad range of other allowable transition costs to be incurred to achieve "comparable capability of systems as before the relocation or sharing arrangement."<sup>4</sup> The plan must also identify any factors that could "hinder fulfillment of the transition plan," including at a minimum the extent to which any classified information will affect "the implementation of the relocation or sharing arrangement."<sup>5</sup>

3. For any federal entity seeking payments for certain pre-auction costs, its transition plan must, to the fullest extent possible, also provide for sharing, coordination, and reasonable accommodations for the use of eligible frequencies by non-federal users during the transition period. A plan identifying pre-auction costs must also provide that: (1) the eligible federal entity will, during the transition period, make itself available for negotiation and discussion with non-federal users; and (2) the eligible federal entity will assist the non-federal user during the transition period by making available relevant classified information to those with appropriate security clearances on a need-to-know basis.<sup>6</sup>

#### **O.4.2 Title Page: Plan Identification, Responsible Officer, Points of Contact and Pre-Auction Transfers Agreement**

1. The "Title Page" or first page of the Transition Plan in accordance with the common format template, includes the official name of the federal entity, along with the name of the Responsible Officer and contact information for its primary and alternate points of contact. It also includes plan identifying information, such as the version and approval date, as well as the pre-auction transfer agreement made by the agency if it requested a transfer for pre-auction costs pursuant to Section 118 (d)(3)(B). This same information, except for the pre-auction transfer agreement, is displayed on the Plan Dashboard in ST2.

2. The Responsible Officer is the officer or employee who is responsible for the federal entity's relocation or sharing efforts and who is authorized to meet and negotiate with non-federal users.<sup>7</sup> Although not required by the statute, a federal entity may voluntarily include the additional contact information for the named "Responsible Officer/Employee." If contact information is provided, non-federal users may contact the federal entity through this individual or through the primary or alternate points of contact. The Responsible Officer and Points of Contact are also the individuals that will be contacted in the event NTIA, the Technical Panel, or a dispute resolution board needs to convey or receive additional information regarding the transition plan process or contents.

3. The date of submission and approval of the plan, as well as revision number (*i.e.*, Rev #) will be noted if the plan includes corrections or changes to a previous plan officially submitted and approved. If

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<sup>2</sup> See 47 U.S.C. § 923(h)(2)(A)-(C).

<sup>3</sup> 47 U.S.C. § 923(h)(2)(D).

<sup>4</sup> 47 U.S.C. § 923(g)(3)(A).

<sup>5</sup> See 47 U.S.C. § 923(h)(2)(H), (h)(7)(A)(ii).

<sup>6</sup> See 47 U.S.C. § 928(d)(3)(B)(ii).

<sup>7</sup> 47 U.S.C. § 923(h)(2)(F)

the federal entity requested pre-auction transfers from the SRF, the Title Page will also include the following:

*Note: In order to receive SRF funding for planning efforts to be conducted prior to the auction, this federal entity has agreed that it will provide (I) to the fullest extent possible, for sharing and coordination of eligible frequencies with non-Federal users, including reasonable accommodation by the eligible Federal entity for the use of eligible frequencies by non-Federal users during the period that the entity is relocating its spectrum uses (in this clause referred to as the “transition period”); and (II) for non-Federal users to be able to use eligible frequencies during the transition period in geographic areas where the eligible Federal entity does not use such frequencies. Additionally, this eligible Federal entity will, during the transition period, make itself available for negotiation and discussion with non-Federal users not later than 30 days after a written request therefor; and during the transition period, make available to a non-Federal user with appropriate security clearances any classified information (as defined in section 798(b) of title 18) regarding the relocation process, on a need-to-know basis, to assist the non-Federal user in the relocation process with such eligible Federal entity or other eligible Federal entities. [47 U.S.C. § 928(d)(3)(B)(ii)]*

This statement is required when requesting transfers for any pre-auction costs, and is included when the submitter, during the ST2 transition plan submission process agrees to and states that the transition plan meets the criteria in section 118(d)(3)(B)(ii) of the NTIA Organization Act, as amended (47 U.S.C. § 928(d)(3)(B)(ii)).

### **O.4.3 Frequencies: Operational and Technical Data**

1. Section 113(h)(2)(A)-(C) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(2)(A)-(C)) requires each transition plan to include the following information: (1) the current use by the federal entity of the eligible frequencies to be auctioned; (2) the geographic location of the federal entity’s facilities or systems; and (3) the frequency bands used by such facilities or systems.

2. The “Frequencies” Tab in ST2 is the source of the operational and technical data regarding the assignments and systems currently using the eligible frequencies in the “Freq-Geo-Transition Timeline” Tab of the common format template. The content includes operating frequency(ies), system name/type, emission bandwidth, receiver bandwidth, area of operation, transmitter/receiver state and latitude/longitude of sites.

### **O.4.4 Transition Timeline**

1. Pursuant to Section 113(h)(2)(D) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(2)(D)), each transition plan must set forth the “steps to be taken by the federal entity to relocate its spectrum use from such frequencies or to share such frequencies, including timelines for specific geographic locations in sufficient detail to indicate when use of such frequencies at such locations will be discontinued by the federal entity or shared between the federal entity and non-federal users.” This timeline is referred to as the “Transition Timeline” and is based on the number of months following the start of transition implementation. Transition begins effective with the successful completion of the auction and, as such, is the default reference event to use when determining transition timelines. However, NTIA may also specify an alternate event in the notification per Section O.3.2.2 or in subsequent guidance, if necessary. The completion of the auction is the date on which bidding in an auction of eligible frequencies concludes in accordance with Section 309(j)(16)(B) of the Communications Act of 1934, as amended. At the conclusion of the auction bidding, the Commission issues a public notice declaring auction bidding closed.

2. The “Timeline” Tab of ST2 provides transition timelines by geographic location for assigned eligible frequencies in sufficient detail to indicate when use of such frequencies at such locations will be discontinued by the federal entity or available for shared access by non-federal users. Within a transition

plan exported from ST2, the “Freq-Geo Transition Timeline” combines and associates the transition timeline data from the Timeline Tab with the operational and technical data from the Frequencies Tab into a single data set. Federal entities should try to identify geographic areas in as much detail as possible. Ideally, the geographic areas would align with the FCC license areas identified to be auctioned. Geographic Areas should be identified using common designators (e.g., two letter state codes) or in accordance with Annex G, Section G.2 of this manual. Any use of other names or areas should be defined in the Notes Tab such that the specific geographic area referenced is identifiable. If there is no further breakdown of the geographical areas for the assignment beyond the authorized operational area as included in the Frequencies Tab, then the abbreviation “AOA” maybe entered in the “Geographic Location associated with Timeline “ data field.

3. As applicable, for each specified geographic location, identify, by months after the start of the transition period, the applicable transition timeline or timelines. It may represent:

- when indefinite sharing can begin pursuant to an applicable arrangement (enter ***Indefinite*** in Sharing Type and a transition timeline in Indefinite Sharing Timeline),
- when temporary coordinated sharing may begin pursuant to an applicable arrangement during the time it takes the entity to vacate the spectrum (enter **Coordinated** in Sharing Type and a transition timeline in Temporary Sharing Timeline), and/or
- when the entity expects the use of the frequency will be discontinued and the assignment deleted (enter a transition timeline in Vacate Assignment Timeline).

4. The estimated transition timeline should be as accurate as possible. Given that the time for funds to be transferred from OMB, as well as the time for funds to flow to the organization executing the transition plan, is variable and unknown, federal entities should include a reasonable period of time for this to occur within their estimated transition timeline.

#### **O.4.5 Funds: Estimated Costs and Expenditure Timeline**

1. Section 113(g)(3)(A) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(3)(A)), defines a broad range of relocation or sharing costs. Subject to further guidance or instructions from NTIA or OMB, for each existing assignment and/or group of system assignments, the federal entity’s transition plan must identify the estimated transition costs, and separately the pre-auction planning costs, that have or will be incurred by a federal entity in order to achieve “comparable capability of systems” as before the relocation or sharing arrangement. A publicly releasable system name is required to be used for purposes of tracking funds. Additionally, the federal entity must identify the costs of any proposed expansion of the capabilities of a federal system, which must be assessed by the Technical Panel as incidental to achieving comparable capability. In providing an explanation of the proposed increase in functionality and how this is incidental as a result of acquiring state-of-the-art replacement system(s) in order to meet the comparable operational scope, federal entities should try to provide this information in such a way as to avoid it being classified or sensitive. However, to the extent that any of this information is classified or sensitive, such data will be handled pursuant to Section O.8 of this Annex.

2. Pursuant to Section 113(g)(3)(B) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(3)(B)), and for purposes of this Annex, “comparable capability of systems” may be achieved by relocating a Federal Government station to a new frequency assignment, by relocating a Federal Government station to a different geographic location, by modifying Federal Government equipment to mitigate interference or use less spectrum, in terms of bandwidth, geography, or time, and thereby permitting spectrum sharing (including sharing among relocated federal entities and incumbents to make spectrum available for non-federal use) or relocation, or by utilizing an alternative technology. Such capability includes the acquisition of state-of-the-art replacement systems intended to meet comparable operational scope, which may include incidental increases in functionality.

3. Under Section 113(h)(2)(G), the transition plan must describe the federal entity’s specific plans and timelines for using the amounts from the SRF for procuring, testing, and deploying new equipment and for covering the broad range of other allowable relocation or sharing costs to be incurred to achieve “comparable capability of systems as before the relocation or sharing arrangement.” The timeline for spending funds is referred to as the “Expenditure Timeline” in the plan and identifies the number of months

following initial transfer of SRF funds during which the funds will be spent. In the Notes Tab, the plan for how the funds will be spent should be provided as part of the general description of plans by systems to support transition of the auctioned spectrum.

4. Additionally, while costs included in a transition plan are deliberately high-level and intended to be released to the public, OMB or the Technical Panel may require agencies to provide “budget-level” details to back up their request for SRF funds as summarized in their transition plans. This supplemental information should be provided to the agency’s OMB Budget Examiner with an information copy being sent to [TransitionPlans@ntia.gov](mailto:TransitionPlans@ntia.gov).

## **O.4.6 Interactions**

Under Section 113(h)(2)(E) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(2)(E)), the transition plan must include the specific interactions between the eligible Federal entity and the NTIA needed to implement the transition plan. The “Interactions” Tab of the common format template and within ST2 provides a free text section for this information. The federal entity should include the nature of the interaction and the approximate date proposed for such interaction. For example, interactions with NTIA will likely include coordination while verifying GMF data and interactions to determine the best option from various alternate frequency assignments.

## **O.4.7 Factors**

1. Pursuant to Section 113(h)(2)(H) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(2)(H)), each transition plan must also identify factors that could “hinder fulfillment of the transition plan by the Federal entity,” including “the extent of classified information and the effect of such information on the implementation of the relocation or sharing arrangement.”<sup>8</sup> The “Factors” Tab of the common format template and within ST2 provides a free text section for this information. Federal entities should explain any potential risk factors that could delay implementation along with an explanation of how or why it may impede the relocation or implementation of the transition plan. If any information is to be excluded from the publicly posted transition plan in accordance with Section O.8 of this Annex, this must be addressed as a factor in this Tab.

2. A plan may include additional factors such as: (a) events and circumstances that impact national security, law enforcement, or public safety functions of the current systems and facilities; (b) unanticipated costs and availability of equipment and personnel; (c) construction seasons, natural disasters and other weather-related issues; (d) considerations with respect to site selection and acquisition; (e) transfer and availability of alternate frequency assignments; or (f) *force majeure*, other extraordinary circumstances and unforeseen events. Options to mitigate risk factors may also be identified and are encouraged, especially with regard to addressing information sharing when classified or other sensitive information is withheld from the transition plan that is released to the public.

## **O.4.8 Notes: Additional Information**

1. The “Notes” Tab of the common format template and within ST2 provides a free text section for providing several types of additional information to help explain the planned transition and justify the requested costs. As applicable, the following additional information should be included: (1) assumptions used to determine transition costs or timelines; (2) paired microwave frequencies that will need replaced at the same time as the eligible frequency; (3) definitions of the geographic areas used for transition timeline in sufficient detail for a reader to understand the specific geographic area(s) associated with the timeline; and (4) an explanation of overall approach to transition and additional detail to fully justify the proposed actions and costs associated with approach.

2. For additional information that refers directly to other items in the transition plan, include the Tab and item name to which it refers, as identified in the other parts of the plan.

3. For updated plans, a note is required that summarizes the changes made to the plan in the revision

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<sup>8</sup> 47 U.S.C. §§ 923(h)(2)(H), 923(h)(7)(A)(ii).

and that references the approval documentation.

#### **O.4.9 Excluded Information**

1. Pursuant to Section 113(h)(7)(B) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(7)(B)), Section O.8 of this Annex sets forth the regulations to ensure that the information contained in publicly released transition plans, and updates thereto, do not contain classified information or other sensitive information. The “Excluded Info” Tab of the common format template, and within ST2, documents the unclassified information that an entity has determined must be excluded from the releasable transition plan and provides a reference to the legal authority for safeguarding and dissemination controls requiring its exclusion.

2. Within ST2, the information in this Tab is automatically generated based on the federal entity using the “sensitivity marking” feature of ST2 to designate each data item or text entry that must be withheld from the public. Marking items this way identifies them as CUI and will ensure that the information will be redacted from the releasable transition plans created as ST2 reports for public consumption. It also creates the table in the “Excluded Info” Tab that besides providing the legal authority for withholding the information also documents the exact information being withheld to satisfy the requirement in Section 113(h)(7)(A)(i)(I), to include “an explanation of the exclusion of any such information, which shall be as specific as possible.”<sup>9</sup>

#### **O.4.10 Classified Annex**

In accordance with Section O.8 of this Annex, if any of the information required to be included in the transition plan of a federal entity is classified information, the entity must exclude this information from the transition plan created and submitted via ST2 and place it in a separate classified annex as specified in Section O.8.

### **O.5 TRANSITION PLAN IMPLEMENTATION**

1. Pursuant to Section 113(g)(6) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(6)), NTIA shall take such actions as necessary to ensure the timely relocation of operations from eligible frequencies or implementation of sharing arrangements. Upon a finding by NTIA that a federal entity has achieved comparable capability of systems, NTIA shall terminate or limit the entity’s authorization and notify the FCC that the entity’s relocation has been completed or sharing arrangement has been implemented. NTIA shall also terminate such entity’s authorization if NTIA determines that the entity has unreasonably failed to comply with the timeline for relocation or sharing submitted by OMB under Section 118(d)(2)(C) of the statute (47 U.S.C. § 928(d)(2)(C)).

2. NTIA will identify the reference event to use when determining transition timelines in the notification per Section O.3.2.2 or in subsequent guidance based on the circumstances surrounding the particular auction and transition scenario. This event marks the start of the “transition implementation” period. The date on which bidding in an auction of eligible frequencies concludes in accordance with Section 309(j)(16)(B) of the Communications Act of 1934, as amended (47 U.S.C. § 309(j)(16)(B)) is the default reference event; however, NTIA may also specify a similar event, if necessary. A ‘similar event’ under certain circumstances may, for example, be the date on which the first license associated with the eligible frequencies is granted pursuant to Section 309(j)(16)(C) of the Communications Act of 1934, as amended (47 U.S.C. § 309(j)(16)(C)); or the date on which applicants for licenses associated with the eligible frequencies may begin pre-grant construction of facilities pursuant to Section 1.2113 of the FCC’s rules (47 CFR § 1.2113). The transition period ends upon the applicable terminations, modifications, or notifications referenced in the previous paragraph.

3. The remainder of this section of Annex O provides general guidance on the development and implementation of coordination procedures, sharing arrangements and other negotiated agreements during the transition period. It also outlines the dispute resolution process established by the statute and NTIA’s

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<sup>9</sup> 47 U.S.C. § 923(h)(7)(A)(i)(I).

rules, and summarizes the procedure to effectuate the termination or modification of frequency assignments.

### **O.5.1 Negotiation and Coordination with Non-Federal Users**

1. Several provisions of the statute encourage negotiation, coordination and spectrum sharing between non-federal users and federal entities. For example, and as discussed above, federal entities may recover from the SRF expenses incurred in connection with spectrum coordination with auction winners. In addition, a transition plan identifying pre-auction costs must provide that the eligible federal entity will, during the transition period, make itself available for negotiation and discussion with non-federal users. All transition plans must set forth “[t]he name of the officer or employee of the Federal entity who is responsible for the relocation or sharing efforts of the entity and who is authorized to meet and negotiate with non-Federal users regarding the transition.”<sup>10</sup>

2. With regard to spectrum sharing in eligible frequencies, the statute contemplates a range of potential arrangements including: (1) short-term or temporary “coordinated” sharing in anticipation of the ultimate relocation of federal entities’ spectrum-related operations; (2) long-term or indefinite sharing between federal entities and non-federal users; and (3) sharing among relocated federal entities and incumbents to make spectrum available for non-federal use.<sup>11</sup> NTIA and the FCC will set forth sharing criteria and other requirements for particular eligible frequencies that are reallocated from federal to either exclusive non-federal use or to shared use in the new regulations governing the new use or combined uses of the bands. Sharing “arrangements” consistent with such criteria and requirements may be set forth in a federal entity’s initial transition plan or negotiated among the affected federal entities, non-federal users and other incumbents. These arrangements will be implemented during the transition period, but some sharing agreements may extend beyond the transition period to ensure adequate coexistence conditions are maintained and enforced.

3. Section 309(j)(16)(C) of the Communications Act of 1934, as amended (47 U.S.C § 309(j)(16)(C)), authorizes the FCC to grant commercial licenses in eligible frequencies prior to relocation of Federal Government operations and the termination of a federal entity’s authorization. However, this provision requires the FCC to condition such licenses by “requiring that the licensee[s] cannot cause harmful interference” to federal operations until associated authorizations have been terminated by NTIA. This provision will be implemented through sharing criteria and interference regulations prescribed by the FCC and through coordination procedures such as those jointly established by NTIA and the FCC in the past.<sup>12</sup>

### **O.5.2 Delayed Spectrum Transition**

During implementation of an approved transition plan, federal entities should take all actions possible to avoid a delayed spectrum transition, including requesting additional SRF payments in accordance with Section O.6.2. However, not earlier than 18 months prior to an approved transition timeline, if a federal entity is confident that a delay of spectrum transition is inevitable, it shall coordinate with any affected licensees and obtain their concurrence to continue operations. NTIA will authorize continued operations past the approved transition timeline on a non-interference basis (NIB). In consideration of agreements made between the delayed federal entity and licensees, NTIA may authorize other use with concurrence of affected licensee.

### **O.5.3 Dispute Resolution**

1. Pursuant to Section 113(i) of the NTIA Organization Act, as amended (47 U.S.C. § 923(i)), if a dispute arises between a federal entity and a non-federal user regarding the execution, timing, or cost of the

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<sup>10</sup> 47 U.S.C. § 923(h)(2)(F).

<sup>11</sup> See 47 U.S.C. §§ 923(g)(3)(A)(iv)(II), (g)(3)(B)(i).

<sup>12</sup> See FCC and NTIA, Coordination Procedures in the 1695-1710 MHz and 1755-1780 MHz Bands, *Joint Public Notice*, GN Docket No. 13-185, DA 14-1023 (July 18, 2014), available at <https://www.ntia.doc.gov/files/ntia/publications/pn-aws3-procedures.pdf> and [https://apps.fcc.gov/edocs\\_public/attachmatch/DA-14-1023A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DA-14-1023A1.pdf).



federal entity's transition plan, either the federal entity or the non-federal user may request that NTIA establish a dispute resolution board to resolve the dispute. NTIA has adopted regulations that govern the working of any dispute resolution boards established by NTIA.<sup>13</sup> Those regulations cover matters related to the workings of a board, including the content of any request to establish a board, the associated procedures for convening it, and the dispute resolution process itself.

2. Membership of a dispute resolution board shall be composed of a representative of OMB, NTIA, and the FCC, each appointed by the head of his or her respective agency. The OMB representative serves as the Chair of any board. With respect to the resolution of any disputes that may arise, the statute and NTIA's rules require a board to meet simultaneously with representatives of the federal entity and the non-federal user to discuss the dispute. A board is required to rule on the dispute within 30 days after a party has requested NTIA to convene the board.

3. The statute's 30-day deadline for responding to formal dispute resolution requests could possibly impact a board's ability to convene, meet with the parties, and adequately address complex cases. At the same time, however, the statute and this Annex encourage cooperation to assure timely transitions between federal and non-federal use of the spectrum. If and when differences surface among federal and non-federal parties, NTIA's rules require the parties to make good faith efforts to solve these problems on an informal basis before submitting a formal request to establish a dispute resolution board. Informal negotiation, mediation, or non-binding arbitration efforts between the parties will help clearly define and narrow the issues that are necessary to bring into the formal dispute resolution process.

4. The scope of a dispute resolution request and, consequently, a board's decision, is limited by the statute and the regulations to matters "regarding the execution, timing, or cost of the transition plan submitted by the federal entity."<sup>14</sup> Although the statute authorizes a dispute resolution board to make binding decisions with respect to such matters that can be appealed to the United States Court of Appeals for the District of Columbia Circuit,<sup>15</sup> a board's decision could, in certain circumstances, have a detrimental impact on certain operations or services that have national security, law enforcement or public safety functions. In such cases, the board may request additional written submissions from an agency regarding the impact of such a decision on the agency's operations, services or functions. Under the rules, the dispute resolution board must also ensure that any decision it reaches does not have a detrimental impact on any national security, law enforcement, or public safety function made known to the board by an agency.

5. A dispute resolution board may not exercise remedial authority that is statutorily granted to other federal agencies. The federal agencies that comprise a board's membership (*i.e.*, FCC, NTIA or OMB) do, however, possess statutory authority to take actions to implement a board's decision. Therefore, a board may make recommendations as to remedies or other corrective actions to the appropriate federal agency that has the statutory authority to take such actions based on the board's findings.

#### **O.5.4 Finding of Comparable Capability**

Federal entities may receive SRF payments to cover costs in order to achieve "comparable capability of systems" as before the relocation or sharing arrangement. For purposes of this Annex, and pursuant to Section 113(g)(3)(B) of the NTIA Organization Act, as amended (47 U.S.C. § 923(g)(3)(B)), "comparable capability of systems" may be achieved as described in Seton O.5.4, paragraph 2 of this Annex. When a federal entity no longer requires use of its assigned eligible frequencies and has successfully implemented its transition plan such that it has achieved comparable capability, or if arrangements have been implemented for sharing between the federal entity and non-federal users, the federal entity shall notify NTIA within 30 days following this milestone by reporting transition complete in ST2, or via alternate means for classified systems. NTIA will use this notification as the basis for its finding related to achievement of "comparable capability" of systems under Section 113(g)(6) of the statute.

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<sup>13</sup> 47 CFR Part 301.

<sup>14</sup> 47 U.S.C. § 923(i)(1).

<sup>15</sup> 47 U.S.C. § 923(i)(7).

## **O.5.5 Termination or Modification of Eligible Frequency Assignments**

Upon a finding by NTIA that a federal entity has achieved comparable capability of systems, NTIA shall terminate or modify the entity's applicable authorizations and notify the FCC that the entity's relocation has been completed or sharing arrangement has been implemented. NTIA shall also terminate or limit such entity's authorization if NTIA determines that the entity has unreasonably failed to comply with the timeline for relocation or sharing submitted by the Director of OMB under Section 118(d)(2)(C) of the NTIA Organization Act, as amended (47 U.S.C. § 928(d)(2)(C)).

## **O.6 TRANSFERS FROM SPECTRUM RELOCATION FUND**

Certain conditions apply prior to the transfer of SRF funds. For example, initial transfers may not occur until the Director of OMB has determined, in consultation with NTIA, the appropriateness of eligible costs and the timeline for relocation or sharing, and OMB's notification to the committees of Congress of planned transfers from the SRF is not disapproved within 30 days following submission to them.

### **O.6.1 Transfers of Pre-Auction Costs**

1. If a federal entity seeks transfers from the SRF for pre-auction costs, the Director of OMB will assess the transition plan submitted to determine if it provides: (1) to the fullest extent possible, for sharing and coordination of eligible frequencies with non-federal users, including reasonable accommodation by the eligible federal entity for the use of eligible frequencies by non-federal users during the period that the entity is relocating its spectrum uses; (2) for non-federal users to be able to use eligible frequencies during the transition period in geographic areas where the eligible federal entity does not use such frequencies; (3) that the eligible federal entity will, during the transition period, make itself available for negotiation and discussion with non-federal users not later than 30 days after a written request therefore; and (4) that the eligible federal entity will, during the transition period, make available to a non-federal user with appropriate security clearances any classified information (as defined in Section 798(b) of Title 18, United States Code) regarding the relocation process, on a need-to-know basis, to assist the non-federal user in the relocation process with such eligible federal entity or other eligible federal entities.

2. Payments for pre-auction costs will be transferred to federal entities at the same time as their approved transition costs 30 days after Congressional notification and the deposit of auction proceeds into the SRF, unless specifically requested in their transition plan to be transferred prior to the auction. If SRF payments are requested prior to the auction, the submitter must affirm during the submission of its transition plan that the transfer of the funds prior to the auction will allow for timely implementation of relocation or sharing, thereby increasing net expected auction proceeds by an amount not less than the time value of the amount of funds transferred.

### **O.6.2 Accelerated Implementation Payments**

Pursuant to Section 118(f) of the NTIA Organization Act, as amended (47 U.S.C. §928(f)), the Director of OMB may, in consultation with NTIA, make additional payments to any eligible federal entity that is implementing a transition plan in order to encourage such entity to complete the implementation more quickly, thereby encouraging timely access to the eligible frequencies that are being reallocated for exclusive non-federal use or shared use. Such payment shall be based on the market value of the eligible frequencies; the timeliness with which the eligible federal entity clears its use of such frequencies; and the need for such frequencies in order for the entity to conduct its essential missions. If approved by OMB, such payment may not be made until 30 days after the Director of OMB has notified Congress.<sup>16</sup>

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<sup>16</sup> OMB Commerce Branch Chief Memorandum, "Information for Eligible Federal Entities Related to Spectrum Transition Plan Updates," AWS-3 Transition Plan Update Information Version No. 17-1, dated Nov. 22, 2016.

### **O.6.3 Subsequent Transfers**

In accordance with Section 118(e)(1)(B) of the NTIA Organization Act, as amended (47 U.S.C. §928(e)(1)(B)), an eligible federal entity may receive more than one transfer from the SRF, subject to prior review and approval by OMB in consultation with NTIA. The eligible federal entity's request for a subsequent transfer and updated transition plan must include an explanation of the need for the subsequent transfer consistent with applicable OMB guidance.<sup>17</sup> If the sum of the subsequent transfer or transfers exceeds 10 percent of the original transfer, the subsequent transfer(s) is/are subject to notice to Congress and GAO not less than 45 days prior to the date of the transfer. The notice and updated transition plan must include an explanation of need for the subsequent transfer that causes such excess above 10 percent.

### **O.6.4 Reporting of Actual Relocation Costs; Retransfer to Fund**

1. In accordance with Section 118(e)(2) of the NTIA Organization Act, as amended (47 U.S.C. §928(e)(2), and Section 31.13 of OMB Circular A-11, an eligible Federal entity that has received transfers from the SRF shall report the entity's actual expenditures to OMB and NTIA on an annual basis pursuant to applicable guidance.

2. An eligible Federal entity that has received transfers from the SRF shall transfer any amounts in excess of actual relocation or sharing costs back to the SRF upon completion of transition. As soon the federal entity achieves comparable capability of systems as before the auction, but prior to reporting completion of its transition plan in ST2, the federal entity must return the balance of unexpended funds. After a federal entity reports completion of transition, NTIA will notify the FCC pursuant to Section O.5.4 of this Annex.

### **O.6.5 Annual Report to Congress and GAO**

In accordance with Section 207 of the CSEA,<sup>18</sup> NTIA will submit to Congress and GAO an annual report on the progress made in adhering to the timelines applicable to relocation from or sharing of eligible frequencies, separately stated on a system-by-system basis and on auction-by-auction basis. This report will include, for each affected federal system and auction: a statement of the estimated relocation or sharing costs set forth in each entity's approved transition plan and any updates thereto; the actual relocation or sharing costs incurred; and the amount of such costs paid from the SRF during the previous year.

## **O.7 ADDITIONAL PAYMENTS FOR RESEARCH AND DEVELOPMENT AND OTHER PLANNING ACTIVITIES**

### **O.7.1 Authorized Payments**

Pursuant to Section 118(g) of the NTIA Organization Act, as amended (47 U.S.C. §928(g)), the Director of OMB may make additional payments requested by federal entities for research and development, engineering studies, economic analyses, or other planning activities intended to improve the efficiency and effectiveness of the spectrum use of federal entities in order to make available frequencies for reallocation for non-Federal use or shared Federal and non-Federal use, or a combination thereof, and for auction in accordance with such reallocation. For purposes of a payment for activities with respect to systems that improve the efficiency and effectiveness of the spectrum use of Federal entities, such systems include (1) systems that have increased functionality or that increase the ability of a Federal entity to accommodate spectrum sharing with non-Federal entities; (2) systems that consolidate functions or services that have been provided using separate systems; and (3) non-spectrum technology or systems.

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<sup>17</sup> *Id.*

<sup>18</sup> Pub. L. No. 108-494, Title II, § 207, 118 Stat. 3996 (Dec. 23, 2004), codified at 47 U.S.C. § 928 note.

## **O.7.2 Spectrum Pipeline Plans**

1. In general, the federal entity or entities submitting a Spectrum Pipeline Plan must fully define the project, including, but not limited to, the following information:

- a. a narrative description of all planned activities that would be funded through the SRF, including anticipated outcomes;
- b. a description of all systems that will be affected by the planned activities, including the purpose of that system and characteristics of usage;
- c. a description of both current spectrum assignments that might be affected by the planned activities and any new spectrum assignments the entity anticipates requesting;
- d. a summary of any new proposed systems, technologies, or applications, if applicable, that will be researched or developed with SRF funding;
- e. the frequencies that are being targeted to be made available for auction or sharing via the proposed project, and a tentative timeline for when the frequencies might become available for commercial use;
- f. measurable goals and objectives, including initial and anticipated Technology Readiness Levels (TRL) for any systems, applications, or technologies that will be researched, developed, modified, or tested as a result of the planned activities;
- g. a detailed budget by year;
- h. a justification for how the project meets the statutory requirements, and
- i. a description of any potential follow-up research, development, or activity that might be required to make the identified frequencies of spectrum available for auction.

2. The submitting entity (or entities, in the case of a joint project) must identify all federal entities, and as appropriate all specific bureaus or offices, that will be directly involved or affected by the project. Entities should describe the planned project management structure and allocation of funding among agencies and bureaus.

3. The plan should include contact information for engineering, policy, legal, and budgetary leads and describe the governance structure of the project, including processes for managing multi-agency stakeholder input into project elements such as project requirements, milestones, and deliverables. Plans should be signed by the head of the federal entity or entities requesting funds prior to submission to the Technical Panel.

4. A Spectrum Pipeline Plan or any supporting documentation should not include any classified information. If such information must be considered for the plan to be properly assessed, the entity should place the information in a separate annex and reference it in its plan. The Technical Panel will make arrangements for submission and briefing of such information. If required, the annex shall be provided to the subcommittee of primary jurisdiction of the congressional.

5. Federal entities will also submit “supporting documentation” to provide additional information and detail on specific aspects of the plan, as outlined in OMB and NTIA guidance. This information may not represent all information the Technical Panel needs to make a decision to approve a plan. Federal entities should anticipate that the Technical Panel may ask for additional information as necessary, and may request meeting(s) to discuss the content of plans.

## **O.7.3 Review by the Technical Panel**

Not later than 120 days after a federal entity submits a spectrum pipeline plan as specified in section O.7.2, the Technical Panel shall approve or disapprove such plan based on consideration of whether the activities that the Federal entity will conduct with the payment will (1) increase the probability of relocation from or sharing of Federal spectrum; (2) facilitate an auction intended to occur not later than 8 years after the payment; and (3) increase the net expected auction proceeds in an amount not less than the time value of the amount of the payment. The Technical Panel must also consider if the transfer will leave sufficient amounts in the Fund for the other purposes of the Fund.

## **O.8 CLASSIFIED AND CONTROLLED UNCLASSIFIED INFORMATION**

Pursuant to Section 113(h)(7)(B) of the NTIA Organization Act, as amended (47 U.S.C. § 923(h)(7)(B)), this section sets forth the regulations to ensure that the information contained in publicly released transition plans, and updates thereto, do not contain classified information or other sensitive information. These regulations have been adopted by NTIA in consultation with the Director of OMB and the Secretary of Defense in accordance with the just-cited statutory provision.

### **O.8.1 Explanation of Terminology Used**

1. The statute cross-references the definition of “classified information” in Section 798(b) of title 18, United States Code, which states as follows: “The term ‘classified information’ means information which, at the time of a violation of this section, is, for reasons of national security, specifically designated by a United States Government Agency for limited or restricted dissemination or distribution.” Accordingly, the definition of this term in Section O.2 of this Annex is derived directly from language in the above-quoted cross-reference.

2. The term “sensitive information” defined above in Section O.2 of this Annex and used in this section is derived from Section 119(a) of the NTIA Organization Act that was added by Section 6703 of the Tax Relief Act (47 U.S.C. § 929(a)). In 2016, regulations were published for the Controlled Unclassified Information (CUI) program established by Executive Order 13556 and establishes policy for designating, handling, and decontrolling information that qualifies as CUI.<sup>19</sup> The CUI program standardizes the way the Executive branch handles unclassified information that requires safeguarding or dissemination controls pursuant to and consistent with law, regulations, and Government-wide policies. CUI categories and subcategories are the exclusive designations for identifying this type of information and all unclassified information throughout the executive branch that requires any kind of safeguarding or dissemination control is by definition CUI. Agencies may not implement safeguarding or dissemination controls for any unclassified information other than those controls permitted by the CUI Program and agencies may use only those categories or subcategories approved by the CUI EA and published in the CUI Registry. Accordingly, all information that would be considered “sensitive information” under 47 U.S.C. § 929 will be referred to and handled as CUI.

### **O.8.2 Submission of CUI and Classified Information in Transition Plans**

1. In the pre-submission information identified under Section O.3.2.2 of this Annex, the federal entity will be requested to indicate whether any of the information required to be included in its transition plan will be marked as classified information or CUI. This allows NTIA to plan accordingly and, if necessary, provide supplemental guidance to the federal entity as it prepares to submit its transition plan. Pursuant to Section 119(a) of the statute (47 U.S.C. § 929(a)), if a transition plan to be submitted to NTIA includes classified and/or CUI that cannot be released to the public, the head of the agency submitting the plan shall notify the Assistant Secretary of Commerce for Communications and Information, prior to the submission of the plan. If for any reason the notification is not provided prior to submission of the transition plan to NTIA, it will be provided as soon as possible after, but no later than 150 days prior to the scheduled start of the auction to enable NTIA to post plans without classified information or CUI on its public website 120 days prior as required by 113(h)(5) of the statute (47 U.S.C. § 923(h)(5)).

2. As discussed in O.4, except for special circumstances, federal entities are required to use the ST2 to prepare and submit transition plans pursuant to the statute and under this Annex. ST2 is an unclassified information system and accordingly, maintains only unclassified data for each transition plan, albeit a complete data set including any non-classified sensitive information or CUI. For ST2 transition plans, it is the responsibility of the federal entity’s “submitter” to ensure any unclassified information that must be withheld from the public is properly marked and documented using the sensitivity marking functionality within ST2. Each federal entity will be required to identify as part of their pre-submission planning information (O.3.2.2) the categories or sub-categories of CUI and any of those that require additional

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<sup>19</sup> 32 C.F.R Part 2002. See also <https://www.archives.gov/cui>.

special handling provisions that may be included in their transition plan. ST2 will make those categories/sub-categories available for marking the CUI information and required labels and marking will be applied to the ST2 banner and all reports containing CUI. The plan submitter during submission must certify that all CUI has been properly designated. Based on this certification, ST2 will create publicly-releasable plan reports that include only, but all, unmarked data items in order to provide all relevant non-classified and non-sensitive information. If agencies have an internal process for clearance of information to the public, this should be done prior to official submission of the transition plan.

3. As required by Section 113(h)(7) of the statute (47 U.S.C. § 923(h)(7)), if any of the information required to be included in the transition plan of a federal entity is classified, the entity must include all relevant non-classified information. Only unclassified information is to be submitted via ST2. NTIA will provide instructions for submitting classified plans in auction-specific guidance, as applicable. Classified information must be placed in a separate document and submitted via secure methods. Submission of a full classified transition plan, with all Tabs including both unclassified and classified information, is preferred for purposes of providing to Congressional committees, as provided for by Section 119(b) of the statute (47 U.S.C. § 929(b)). At a minimum, however, all classified information withheld from the unclassified plan submitted via ST2 will be provided in the format of the appropriate Tab for the information excluded using the common format outlined in the Appendix. Each classified Tab shall be properly formatted with column headings and portion markings at the paragraph, section, data line, or data element level, as applicable. For any classified assignments, only those data elements appropriately marked in the GMF or classified by another referenceable source may be excluded. If the classified content of a transition plan is submitted separate from the unclassified/CUI portions of the plan, it shall be submitted as a classified annex with an appropriate cover page associating it with the corresponding unclassified plan, with required classified marking elements (e.g., classified by, declassify on). When there are two parts to a transition plan (i.e., a main unclassified plan with a classified annex), the plan is not considered formally submitted for purposes of beginning the timeline that the Technical Panel has to review a plan pursuant to 113(h)(4)(A) of the statute (47 U.S.C. § 923(h)(4)(A)) until both the unclassified and classified portions are submitted. Additionally, within the main, publicly available transition plan, the federal entity must address two additional requirements. Pursuant to Section 113(h)(7)(A)(i)(I) of the statute (47 U.S.C. § 923(h)(7)(A)(i)(I)), the federal entity shall provide an explanation of the exclusion of any classified information or classified assignments, which shall be as specific as possible. This should be included in the Notes section of the transition plan. The federal entity shall also discuss as a factor the extent of the classified information and the effect of such information on the implementation of the relocation or sharing arrangement in the “Factors” section of the transition plan. At a minimum, the releasable plan must indicate that there is federal use for which no information can be provided.

4. For situations when the common format template is used in lieu of ST2 for submission of a federal entity’s transition plan that contains classified information or CUI, the federal entity shall create two versions of the transition plan. The federal entity shall submit a releasable plan with an “Excluded Info” tab that excludes any classified and other CUI. Omissions shall be clearly annotated and addressed as outlined in 2 and 3 above. Additionally, a complete but separate classified or CUI transition plan must be submitted as a classified annex including CUI, or a CUI annex, as applicable, to the releasable plan. It must follow the transition plan common format template and have all required information, with both classified or CUI, appropriately marked and labeled.

### **O.8.3 Use, Access and Disclosure of Classified Information and Assignments and Other Sensitive Information in Transition Plans**

1. If the requirements in Section O.8.2 above with regard to information properly designated as CUI within ST2 and any separate, appropriately marked annexes and notifications are met, NTIA will take appropriate measures to prevent any such CUI or annexes from being disclosed to the public or provided to any unauthorized person through any means. Specifically, with regard to a transition plan that must be published on NTIA’s website in accordance with Section O.3.7 of this Annex, no classified or CUI annex to such plan will be included. In addition, while no specific classified assignments contained in such annexes will be included in publicly available transition plans, the federal entity will provide consolidated

cost figures and timelines derived from these assignments to be disclosed as part of the main transition plan, as well as the explanation and factor discussion required by Section 113(h)(7)(A) of the statute (47 U.S.C. § 923(h)(7)(A)).

2. All parts of each transition plan, including any classified information or CUI, will be made available to the members of the Technical Panel or a dispute resolution board who have the appropriate security clearances and in accordance with appropriate national security stipulations. All parts of each transition plan, including any classified or CUI annex, may also be made available, pursuant to Sections 113(g)(5) and 119(b) of the NTIA Organization Act (47 U.S.C. §§ 923(g)(5) and 929(b)), to the subcommittee of primary jurisdiction of the congressional committee of primary jurisdiction in accordance with appropriate national security stipulations.

3. 3. With regard to the notifications of estimated relocation and sharing costs and timelines that NTIA must provide to OMB, the FCC, and GAO in accordance with Section O.3.6 of this Annex, NTIA will transmit the consolidated cost figures and timelines derived from all non-classified, CUI, and classified information in each transition plan as well as the main part of underlying transition plans. Upon request, NTIA will make information contained in a classified or CUI annex available to authorized personnel in accordance with appropriate national security stipulations.

APPENDIX: COMMON FORMAT FOR TRANSITION PLANS

Title Page

Releasable or CUI Heading

[Federal Entity] [Band] [(Plan Version)] [(Plan Status)]

Submitted: [Date Submitted to NTIA and Technical Panel]

Approved: [Date approved by Technical Panel]

	First Name	Last Name	Office/Title	Phone Number	E-mail
Responsible Officer					
Primary Contact					
Alternate Contact					

Note: In order to receive SRF funding for efforts to be conducted prior to the auction, this federal entity has agreed that it will provide (I) to the fullest extent possible, for sharing and coordination of eligible frequencies with non-Federal users, including reasonable accommodation by the eligible Federal entity for the use of eligible frequencies by non-Federal users during the period that the entity is relocating its spectrum uses (in this clause referred to as the “transition period”); and (II) for non-Federal users to be able to use eligible frequencies during the transition period in geographic areas where the eligible Federal entity does not use such frequencies. Additionally, this eligible Federal entity will, during the transition period, make itself available for negotiation and discussion with non-Federal users not later than 30 days after a written request therefor; and during the transition period, make available to a non-Federal user with appropriate security clearances any classified information (as defined in section 798(b) of title 18) regarding the relocation process, on a need-to-know basis, to assist the non-Federal user in the relocation process with such eligible Federal entity or other eligible Federal entities. [47 U.S.C. § 928(d)(3)(B)(ii)]

Note added, as applicable, if funds are requested for pre-auction planning costs.



## Frequency –Geographical Location (Freq-Geo) Transition Timeline

Releasable or CUI Heading

[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Freq-Geo Transition Timeline

Serial Number	System Name	Center Lower Frequency (MHz)	Upper Frequency (MHz)	Emission Bandwidth (MHz)	Receiver Bandwidth (MHz)	System Use Type Name	Operation Area	Transmitter State	Transmitter Latitude	Transmitter Longitude

Releasable or CUI Heading

[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Freq-Geo Transition Timeline

Serial Number	Receiver State	Receiver Latitude	Receiver Longitude	Frequency Remarks	Geographic Location associated with Timeline <i>(AAO in this column indicates the timeline is associated with the geographic location defined by the Authorized Area of Operation in the frequency assignment)</i>	Sharing Type <i>(Indefinite, Temporary (i.e., Coordinated), or None)</i>	Indefinite Sharing Timeline <i>(Months after Start of Transition)</i>	Temporary Sharing Timeline <i>(Months after Start of Transition)</i>	Vacate Assignment Timeline <i>(Months after Start of Transition)</i>

## Funds

Releasable or CUI Heading							
[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Funds							
System Name	Total Pre-Auction Cost (\$M)	Funds Requested Prior to Auction (\$M)	Transition Implementation Cost (\$M)	Total Cost (\$M)	Begin Expenditure Timeline (Months after Receipt of Funds)	End Expenditure Timeline (Months after Receipt of Funds)	Expanded Capability Cost (\$M)
<b>Total</b>	\$M.xxxx	\$M.xxxx	\$M.xxxx	\$M.xxxx			\$M.xxxx

Releasable or CUI Heading		
[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Funds		
System Name	Expanded Capability Description	Expanded Capability Justification
<b>Total</b>		

Interactions

Releasable or CUI Heading	
[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Interactions	
Interaction Name	Interaction Description

Impact Factors

Releasable or CUI Heading

[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Impact Factors

Factor Name	Factor Description

## Notes

Releasable or CUI Heading

[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Notes

Note Name	Note Text

### Excluded Information (Info)

Releasable

[Federal Entity] [Band] [(Plan Version)] [(Plan Status)] - Excluded Info

[illegible]

**(Last Page in Annex O)**

## Summary of Changes

### S.1 January 2023 Revision of the January 2021 Edition

Manual Section	Brief Description	IRAC Doc #
Sec. 1.3.2 Annex G	Pension Benefit Guaranty Corporation (PBGC) added as an IRAC nonmember agency and the Department of Treasury is designated as its accredited agent on the IRAC, its subcommittees, and ad hoc groups.	45347/1
Sec. 1.3.2	Department of Transportation is added as a member agency to the Emergency Planning Subcommittee (EPS), Radio Conference Subcommittee (RCS), and Technical Subcommittee (TSC).	45127/1 45128/1 45132/1
Sec. 1.3.2	National Security Agency added as an observer to the Radio Conference Subcommittee (RCS) and Spectrum Planning Subcommittee (SPS).	45261/1
Sec. 1.3.2	Changed Defense to Defense Information Systems Agency in the IRAC Observers section and within the Radio Conference Subcommittee (RCS) and Space Systems Subcommittee (SSS) memberships for clarification.	Editorial
Sec. 1.3.2	Changed Defense to National Security Agency in the Frequency Assignment Subcommittee (FAS) as approved on Doc. 15474/1	Editorial
Sec. 8.3.15	Addition of 65 Coordination Contours for the Department of Commerce, the Department of Air Force and the National Aeronautics and Space Administration	45300/1 45320/2
Sec. 9.8.2.39.b (3)	Adds designation for entry of kiloHertz in the first space for Frequency Band Data (FRB)	45226/1
Annex A	Removed Special Series Note S946 as NASA's International Space Station RapidSeat operations have been discontinued.	45133/1
Annex A	Added new Special Series Note S976 for the NASA-Indian Space Research Organization Synthetic Aperture Radar (NISAR) mission.	45346/1
Annex A	Added three new Special Series Notes supporting DOC operations: S973 for the OceanSat-3 operations; S974 for the Argos Data Collection System (DCS) operations; and S975 for the Deep Space Climate Observatory (DSCOVR) operations.	45157/1
Annex C	Modify locations, supporting the Air Force Life Cycle Management Center, in Annex C, Authorized Sites for Certain Federal Experimental Stations under 7.11.	45228/1
Annex G	Added 36 new Manufacture Codes to Section G.5	45176/1
Annex G	Added POE – Port of Entry to Section G.4 – Common Abbreviations	45177/1
Annex G	Added CP – Camp and JB – Joint Base to Section G.4 – Common Abbreviations	45227/1
Annex G	Updated three Bureau Agency Codes and deleted two others for Transportation in Section G.1	45276/1

### S.2 January 2022 Revision of the January 2021 Edition

Manual Section	Brief Description	IRAC Doc #
Sec. 1.2.1	Updated NTIA and Office of Spectrum Management Organizational Chart	Editorial
Sec. 4.1.3	Modified Table of Frequency Allocations to reflect changes made to the June 28, 2021, FCC online version.	Editorial
Sec. 6.1.1.	Added a definition for the Government Master File (GMF).	Doc. 44710/1
Sec. 6.5.3	Updated to MMSI and Call Sign Information	Doc. 45017/1
Sec. 8.3.15	Addition of coordination contours for the NASA operations at White Sands, NM; Army SMDC Payload Demonstration Lab; Air Force transportable Mobile Ground Station (TMGS); and Commerce operations at Fairbanks, AK and Wallops Island, VA.	Doc. 44838/1
Sec. 8.3.17	Modified to reflect the allocation decisions the Commission made at the WRC-07 R&O (FCC 15-150) that affect the aeronautical mobile telemetry (AMT)	Doc. 44313/1
Sec. 9.1.2	Added language exempting a frequency assignment from a radio frequency device that is fully contained within an anechoic chamber or a Faraday cage.	Doc. 44839/2
Sec. 9.7.1	Adds "the Classification (CLA)"	Doc. 43332/1
Sec. 9.8.2.6	Adds item (c.) correcting classification concern with modification proposals	Doc. 45101/1
Sec. 9.8.2.6(b)	Changed the Classification.	Doc. 42165/1
Sec. 9.8.2.29(b)	Modified the antenna spelling to match Annex G.	Doc. 45052/1

Sec. 9.8.2.38(b)		
Annex A	Updated seven Special Series Notes: S966 for NASA Polarimeter to Unify the Corona and Heliosphere (PUNCH); S967 for NASA Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites (TRACERS); S968 for NASA Total and Spectral Solar Irradiance Sensor-2 (TSIS-2); S969 for NASA Interstellar Mapping and Acceleration Probe (IMAP); S970 for NASA Global Lyman-alpha Imagers of the Dynamic Exosphere (GLIDE); S971 for Surface Water and Ocean Topography (SWOT); and S972 for NASA Psyche.	Doc. 44866/1
Annex C	Added a DHS location in Annex C	Doc. 45051/1

### S.3 January 2021 Edition

Manual Section	Brief Description	IRAC Doc #
Preface	Deleted duplicate and out-of-date information “About this Manual”.	Editorial
Section 1.1	Updated information on current authorities and functions.	Editorial
Sec. 1.3.2	Modified Article V, Section 3, of the IRAC Bylaws to update functions of the Spectrum Planning Subcommittee (SPS) function.	Doc. 43963/1
Preface Sec. 1.3.2 Annex G	Modified IRAC bylaws, other references and abbreviations (e.g., Preface, Table G.1. of Annex G) to reflect name change of “Broadcasting Board of Governors” (BBG) to “United States Agency for Global Media” (USGM).	Doc. 44087/1
Sec. 4.1.3	Modified Table of Frequency Allocations to reflect changes codified in the Oct. 1, 2020 version of Sec. 2.106 of the print edition of Title 47 of the Code of Federal Regulations (47 CFR 2.106).	Editorial
Sec. 4.1.3	Modified Government Footnote G2 to include Footnote US269 as a reference.	Doc. 43148/1
Sec. 4.3.4.3 Sec. 8.3.17 Sec. 9.8.2 Annex D	Modified Sections 4.3.4.3, 8.3.17, 9.8.2.26.b(11), 9.8.2.27.c(2)(p), 9.8.2.29.b(1)(p), 9.8.2.35.b(11), 9.8.2.36.c(2)(p), 9.8.2.38.b(1)(p), Table 2 and Figure 2 in Annex D, and Government Footnote G2. The modifications removed Non-Federal allocations from the bands 2310-2320 MHz and 2345-2395 MHz in accordance with changes made to the Aeronautical Mobile Telemetry (AMT) by the WRC-07 Report and Order (FCC 15-50).	Doc. 44313/1
Sec. 4.3.7 Sec. 5.3.11 Annex A	Modified Section 4.3.7 to add the 6.25 kHz necessary bandwidth. Modified Section 5.3.11 to add the band 162-174 MHz for Fixed and Mobile Digital 6.25 kHz Channel Equipment. Modified Annex A to Update Notes S391 and S396.	Doc. 44531/1
Sec. 4.3.19	Updated 7125-8500 MHz Channeling Plan to accommodate new technologies to improve the overall spectrum efficiency and increase effectiveness.	Doc. 44577/1
Sec. 5.2.2.2	Modified to make it explicit that the emissions standards are meant to be symmetrical with respect to the assigned frequency.	Doc. 43603/1
Sec. 5.3.3.3	Modified tables 5.3.3 and 5.3.4, and created a new table 5.3.5 that includes new standards for small parabolic antennas for federal fixed service systems that operate in the band 7.125-8.5 GHz.	Doc. 43665/1
Sec. 5.3.3.5	Added a new section for the Spectrum Efficiency Standards for Fixed Service to harmonize with FCC standards, taking into account the challenges federal agencies typically face in deploying radio systems that could include lengthy appropriation and procurement cycles, and design changes to adapt to their mission needs.	Doc. 44188/1
Sec. 7.1 Sec. 7.5.8 Sec. 7.5.9 Sec. 7.14 Sec. 7.23 Sec. 7.25	Modified Section 7.25 to add authority for certain use of electronic attack and electronic countermeasures by Departments of Justice and Homeland Security against unmanned aircraft systems in accordance with Section 1602(a) of the Preventing Emerging Threats Act of 2018. Updated Section 7.14 regarding the use of electronic attack and electronic countermeasures by the Department of Defense. Revised Section 7.23 to provide agencies maximum flexibility to use commercial and other licensed services that are authorized by the FCC and introduced into the market. Made conforming changes to Sections 7.1, 7.5.8, and 7.5.9.	Doc. 43863/2
Sec. 7.11 Annex C	Significantly revised Section 7.11 to facilitate use of certain frequencies by Federal experimental stations without prior NTIA approval. Addressed Navy request for a new location at Jamesburg, CA and administrative adjustment for Midway Research Facility.	Doc. 44417/2 Doc. 44487/1
Sec. 8.2.30	Modified procedures for reporting Cases of harmful interference.	Doc. 43795/1
Sec. 8.2.44	Added new section to establish policy guidance for spectrum certification of launch vehicles.	Doc. 43892/2



<b>Manual Section</b>	<b>Brief Description</b>	<b>IRAC Doc #</b>
Sec. 8.2.53	Modified to exempt some small satellite systems from the requirement that the tracking, telemetry and command (TT&C) subsystem receive Stage 4 certification of spectrum support.	Doc. 43503/1
Sec. 8.2.54	Modified policy concerning use of frequencies in the band 420-450 MHz by Range Safety Operations.	Doc. 43643/1
Sec. 8.3.7 Annex A	Updated Section 8.3.7 and Annex A Coordination Note C069 concerning coordination of Geostationary Operational Environmental Satellite Terrestrial Data Collection Platforms (DCP).	Doc. 43876/1
Sec. 8.3.15	Addition of coordination contours for the Air Force Mobile CubeSat Command and Control (MC3) Ground Station.	Doc. 43893/1
Sec. 8.3.15	Added coordination contours for the Navy Naval Research Laboratory Chafsat, NASA White Sands, NM, and Air Force for the L-3 COM Ground Multi-Band Terminal (GMT), USAPW, FalconSAT-6, and MONOLITH CubeSat Experiment ground stations.	Doc. 43940/1
Sec. 8.3.15	Added coordination contours for the Commerce GOES-R ground stations.	Doc. 44284/1
Sec. 8.3.15	Added coordination contours for the NASA operations at Killebrew, OH and Boardman, OR; and the Air Force S5 Micro-Satellite System, Global Space Telemetry Resource (GSTR), and AN/FRC-178 Ground Antenna Station.	Doc. 44285/1
Sec. 8.3.15	Added coordination contours for the Air Force Mobile Cubesat Command and Control (MC3) Ground Stations, ORCA CubeSat, MIT-LL Over-the-Air Ka Test Terminal (OTAKaTT); and NASA Kennedy Space Center (RFTS) and FLNASA WG5 Antenna. (RFTS), FL.	Doc. 44286/1
Sec. 8.3.16 Annex A	Modified Section 8.3.16.3(7) and added a new Special Note S409 concerning temporary United States & Possessions (US&P) frequency assignments for testing prior to receiving Stage 4 Spectrum Certification.	Doc. 43565/1
Sec. 8.3.26 Annex A	Updated Section 8.3.26 and Coordination Note C092 to correct the Patuxent River, MD operating area by integrating the Atlantic Test Range boundaries and associated Atlantic Coastal Waters.	Doc. 43304/1
Sec. 8.3.32 Sec. 9.8.2 Sec. 9.10 Sec. 9.11.4	Modified Sections 8.3.32.6.b, 9.8.1, 9.10, 9.11.4, and 9.8.2.41 to change the Agency Handling Instructions (AHI) code to FOI (Freedom of Information Act).	Doc. 43740/1
Sec. 9.8.2	Added an Agency Specific Function Identifier to Section 9.8.2.39u concerning APRS Weather Stations.	Doc. 44204/1
Sec. 9.8.2 Annex A	Modified Section 9.8.2.39.j.(3) and Special Note S945 to change "Nanosat" to "smaller satellite."	Doc. 43368/1
Chapter 10	Updated chapter to reflect revisions to OMB Circular A-11 and to make it more concise and accessible.	Doc. 44055/2
Chapter 12 Sec. 7.3 Sec. 7.5.3 Sec. 7.5.4 Sec. 7.5.6 Sec. 7.24	Added a new chapter to consolidate provisions related to emergency readiness. Sections 7.3, 7.5.3, 7.5.4, 7.5.6, and 7.24 moved to new chapter.	Doc. 44259/3
Annex A	Removed Record Notes that are no Longer in use in the Government Master File: E013, L174, L201, L294, L309, L331, L332, L343, L353, M011, S151, S170, S171, S186, S196, S211, S264, S279, S292, S330, S341, S344, S351, S357, S368, S576, S626, S696, S703, S707, S713, S714, S722, S775, S780, S786, S787, S821, S887, S920, S934, and S938.	Doc. 43875/1
Annex A	Added Special Series Note S408 to support DoD AIMS Platform Level Certification Testing.	Doc. 43564/1
Annex A	Added Special Series Notes: S960 for NASA Landsat-9; S961 for NASA Lucy; S962 for NASA Plankton, Aerosol, Cloud, Ocean Ecosystem (PACE); S963 for NASA Restore-L; and S964 for NASA Wide Field InfraRed Survey Telescope (WFIRST) Mission.	Doc. 43737/1
Annex A	Removed Special Series Note S379 because the Operation Alliance Program was discontinued.	Doc. 43877/1
Annex A	Added a Special Series Note S965 for Mars 2020 Rover mission.	Doc. 44205/1
Annex A	Added a new Coordination Note C090 for frequency assignments in the Aeronautical Mobile Telemetry (AMT) band 5091-5150 MHz that have been coordinated with the FAA,	Doc. 44314/1

<b>Manual Section</b>	<b>Brief Description</b>	<b>IRAC Doc #</b>
	FCC, and AFTRCC.	
Annex A	Modified C013, C015, S643 S904 and deleted S616.	Doc. 44594/1
Annex A	Corrected contact information in Coordination note C027.	Doc. 44486/1
Annex A Annex F	Updated Special Series Note S400 and Annex F by correcting the names for the Aeronautical Advisory Group (AAG) and the Military Advisory Group (MAG), and added a new provision in Annex F for delinquent frequency assignments beyond the five year and ten year review period by adding an expiration date (EXD) of seven and twelve years, respectively.	Doc. 44206/1
Annex D	Corrected the names for the Aeronautical Advisory Group (AAG) and the Military Advisory Group (MAG), and updated contact information.	Doc. 43874/1
Annex G	Added Bureau Code NCC (National Coordination Center).	Doc. 43878/1
Annex G	Added or modified Manufacturer Codes.	Doc. 44108/1
Annex G	Updated antenna abbreviations.	Doc. 44616/1
Annex G	Removed the International Boundary and Water Commission (IBWC).	Doc. 44617/1
Annex G	Updated Coast Guard Areas and Districts to include a new map.	Doc. 44315/1
Annex J	Updated to provide guidance for determining the necessary bandwidth of federal radiocommunications systems.	Doc. 43500/2
Annex J	Updated Table A to revise the -20 dB Necessary Bandwidth Equation for Frequency Modulated Chirp Pulsed Waveforms.	Doc. 43758/1
Annex J	Created a new Section (J.3.4) for pulse code modulation/phase modulation (PCM/PM) necessary bandwidth equations.	Doc. 43871/1
Annex M	Updated to describe procedures and references for collecting measurement data for fixed and mobile services.	Doc. 44069/1
Annex O	Updated to reflect revised statutory requirements and other changes for transition planning and use of Spectrum Relocation Fund under Spectrum Pipeline Act and MOBILE NOW Act.	Doc. 44597/2

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