

**Fourth Interim Progress Report on the
Ten-Year Plan and Timetable
and
Plan for Quantitative Assessments
of Spectrum Usage**



U.S. Department of Commerce

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1. INTRODUCTION

Summary

The National Telecommunications and Information Administration (NTIA) submits this *Fourth Interim Progress Report* in response to the Presidential Memorandum issued on June 28, 2010, directing the Secretary of Commerce, working through NTIA and in collaboration with the Federal Communications Commission (FCC), to identify and make available 500 megahertz of federal and non-federal spectrum by 2020 for expanded wireless broadband use.¹

In October 2010, pursuant to the *2010 Presidential Memorandum*, NTIA, with input from the Policy and Plans Steering Group (PPSG), issued a Plan and Timetable to achieve the President's 500 megahertz goal over the next ten years.² The Plan identified over 2,200 megahertz of spectrum for evaluation, the process for evaluating candidate bands, and the steps necessary to make selected spectrum available for wireless broadband services. Taking into account the significance of protecting vital government missions that rely on spectrum, NTIA's *Ten-Year Plan* identified over 2,200 megahertz of federal and non-federal spectrum bands for evaluation, proposed a process for evaluating candidate bands, and set forth the steps necessary to select and make spectrum available for wireless broadband services.

Between October 2010 and September 2013, NTIA formally recommended or otherwise identified for potential reallocation up to 405 megahertz in the following bands:

- 15 megahertz from the 1695-1710 MHz band
- 100 megahertz from the 3550-3650 MHz band
- 95 megahertz from the 1755-1850 MHz band; and
- 195 megahertz from the 5350-5470 MHz and 5850-5925 MHz bands

The FCC has initiated rulemaking proceedings for these and other bands based upon the National Broadband Plan.³ NTIA and the FCC have also made significant progress toward the implementation of the key spectrum-related provisions of the Middle Class Tax Relief and Job

¹ See Memorandum for the Heads of Executive Departments and Agencies, *Unleashing the Wireless Broadband Revolution* (rel. June 28, 2010), published at 75 Fed. Reg. 38387 (July 1, 2010), available at <http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution> (2010 Presidential Memorandum).

² NTIA, *Plan and Timetable to Make Available 500 Megahertz of Spectrum for Wireless Broadband* (Oct. 2010), available at http://www.ntia.doc.gov/files/ntia/publications/tenyearplan_11152010.pdf (*Ten-Year Plan*). The PPSG is an advisory group of senior federal officials who advise NTIA on achieving the objectives of the 2010 Presidential Memorandum. See *2010 Presidential Memorandum* at § 1(c).

³ See *Connecting America: The National Broadband Plan*, GN Docket No. 09-51, Recommendation 5.8 (2010), available at <http://www.broadband.gov/plan/>.

Creation Act of 2012,⁴ with spectrum auctions to be held in 2014 and 2015.

On June 14, 2013, President Obama issued a second related memorandum, entitled *Expanding America's Leadership in Wireless Innovation*, through which the Administration seeks to make more spectrum available for commercial use by allowing and encouraging shared access by commercial providers to spectrum that is currently allocated for federal use.⁵ As both memoranda make clear, innovative spectrum sharing technologies can enhance efficiency among all users and expedite commercial access to additional spectrum bands where technically and economically feasible. The second memorandum directs federal agencies to take a number of steps to accelerate shared access to spectrum, including making quantitative assessments of actual spectrum usage in accordance with the plan set forth in Appendix A of this report, which will evaluate whether up to 960 megahertz of additional spectrum could potentially be made available for sharing with, or release to, commercial users, particularly in major metropolitan areas, without adversely affecting agencies' missions.

Key Accomplishments

This *Fourth Interim Progress Report* summarizes and assesses the progress made from October 1, 2012 through September 30, 2013 in implementing the October 2010 *Ten-Year Plan*.⁶ The key accomplishments for this reporting period include the following:

- NTIA's Commerce Spectrum Management Advisory Committee (CSMAC) concluded its groundbreaking work to explore relocation alternatives and spectrum sharing arrangements between federal agencies and commercial mobile broadband systems in the 1695-1710 MHz and 1755-1850 MHz bands.
- NTIA released regulations and guidance implementing changes to the Commercial Spectrum Enhancement Act (CSEA) that provide eligible federal agencies incentives and financial assistance to facilitate the transition of the reallocated federal bands that the FCC will auction.
- NTIA published an initial assessment on spectrum-sharing technologies and the risk to federal users if Unlicensed-National Information Infrastructure (U-NII) devices were

⁴ See Pub. L. No. 112-96, Title VI, 126 Stat. 201 (Feb. 22, 2012), available at <http://www.gpo.gov/fdsys/pkg/PLAW-112publ96/pdf/PLAW-112publ96.pdf> (*Tax Relief Act*).

⁵ See Memorandum for the Heads of Executive Departments and Agencies, *Expanding America's Leadership in Wireless Innovation* (rel. June 14, 2013), published at 78 Fed. Reg. 37431 (June 20, 2013), available at <http://www.whitehouse.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovatio> (2013 *Presidential Memorandum*). The memorandum also strongly encourages the FCC to identify "spectrum allocated for nonfederal uses that can be made available to agencies, on a shared or exclusive basis." See *id.* at § 7(b).

⁶ See 2010 *Presidential Memorandum* at § 1(d). This report references some activities that occurred after September 30, 2013.

authorized to operate in the 5350-5470 MHz and 5850-5925 MHz bands (5 GHz).

- NTIA, in collaboration with the federal agencies, developed the plan set forth in Appendix A for federal agencies to provide quantitative assessments of their usage of spectrum in selected frequency bands.
- The FCC initiated or concluded rulemaking proceedings⁷ for the following spectrum bands and services:
 - 40 megahertz from the 2000-2020 MHz and 2180-2200 MHz bands for Advanced Wireless Services (AWS-4);
 - 10 megahertz from the 1915-1920 MHz and 1995-2000 MHz bands (H Block);
 - 70 megahertz from the 1695-1710 MHz, 1755-1780 MHz, 2020-2025 MHz, and 2155-2180 MHz bands for flexible Advanced Wireless Services (AWS-3);
 - 100 megahertz from the 3550-3650 MHz band (3.5 GHz) for introducing small cell and other technologies on a shared basis with incumbent users; and
 - 295 megahertz from 5150-5250, 5350-5470 MHz, and 5850-5925 MHz in the 5 GHz band for U-NII devices.

This report also provides an update on additional related activities of the FCC and the international spectrum community.

Looking ahead, NTIA and the FCC, along with federal and non-federal stakeholders will continue to address the increasing radio spectrum needs of both federal and non-federal users. In implementing the *2010 Presidential Memorandum*, the *Tax Relief Act*, and the *2013 Presidential Memorandum*, NTIA will continue to engage federal and industry stakeholders to ensure a smooth transition of the 1695-1710 MHz and 1755-1780 MHz bands as the FCC develops service rules for the upcoming auction. In cooperation with these stakeholders, NTIA and the FCC will also be developing sharing options to accommodate new and innovative broadband applications and devices in the 3.5 GHz and 5 GHz bands. NTIA and certain federal agencies will implement the *Plan for Quantitative Assessments of Spectrum Usage*.

⁷ As summarized in the *Third Interim Report*, the FCC concluded in October 2012 a proceeding to facilitate wireless broadband deployment in 30 megahertz of spectrum from the 2305-2320 MHz and 2345-2360 MHz Wireless Communications Service (WCS) bands. That report also summarized the proposed framework for the broadcast television incentive auction rulemaking proceeding commenced in September 2012 through which spectrum from the 600 MHz band would be cleared for new mobile broadband services and devices. See NTIA, *Third Interim Progress Report on the Ten-Year Plan and Timetable* (Nov. 29, 2012), available at http://www.ntia.doc.gov/files/ntia/publications/third_interim_progress_report_final.pdf (*Third Interim Report*).

Background

Concurrent with the development of the *Ten-Year Plan*, NTIA selected four spectrum bands and worked with other federal agencies to perform a “fast track” evaluation to determine whether any of the bands could be made available for commercial wireless broadband services within five years.⁸ This evaluation resulted in the identification of 15 megahertz in the 1675-1710 MHz band, and 100 megahertz in the 3550-3650 MHz band for reallocation, subject to certain geographic limitations.⁹ In furtherance of the recommendations in the *Fast Track Report*, NTIA formally recommended to the FCC that it take regulatory action to repurpose the 1695-1710 MHz and 3550-3650 MHz bands for wireless broadband use on a shared basis.¹⁰

NTIA next selected the 1755-1850 MHz band for detailed evaluation based on the nature of the current federal uses of this spectrum, the likelihood of successfully repurposing the band within ten years, its allocation to the mobile service worldwide, the existence of mature wireless equipment, and the band’s advantageous propagation characteristics for mobile broadband operations.¹¹ In conjunction with agency and industry representatives, NTIA initiated collaborative efforts through the CSMAC to develop recommendations to facilitate mobile broadband access to the 1695-1710 MHz and 1755-1850 MHz bands.¹²

On February 22, 2012, the President signed the *Tax Relief Act* providing for, as recommended in the *Ten-Year Plan*, support from the Spectrum Relocation Fund for federal users.¹³ The *Tax Relief Act* also requires, as recommended in the *Fast Track Report*, the

⁸ NTIA, *An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500-3650 MHz, and 4200-4220 MHz, 4380-4400 MHz Bands* (Oct. 2010), available at http://www.ntia.doc.gov/files/ntia/publications/fasttrackevaluation_11152010.pdf (*Fast Track Report*).

⁹ NTIA’s *Fast Track Report* also recommended that the Federal Government begin working within domestic and international processes to consider the reallocation of 4200-4220 MHz and 4380-4400 MHz bands for wireless broadband.

¹⁰ See Letter from Karl B. Nebbia, Assoc. Admin. Office of Spectrum Mgt., NTIA, to Julius Knapp, Chief, Office of Eng. and Tech., FCC (Jan. 19, 2011), available at http://www.ntia.doc.gov/files/ntia/publications/ntia_fcc_letter_115_mhz_01192011.pdf (*Jan. 2011 Letter to FCC*). See also U.S. Dept. of Commerce, *Identification of 15 Megahertz of Spectrum Between 1675 and 1710 MHz for Reallocation from Federal Use to Non-Federal Use Pursuant to Section 6401(a) of the Middle Class Tax Relief and Job Creation Act of 2012*, (Feb. 2013), available at http://www.ntia.doc.gov/files/ntia/publications/1675-1710_mhz_report_to_president_02192013.pdf. (*1675-1710 MHz Report*).

¹¹ See NTIA, *An Assessment of the Viability of Accommodating Wireless Broadband in the 1755-1850 MHz Band* (Mar. 2012), available at http://www.ntia.doc.gov/files/ntia/publications/ntia_1755_1850_mhz_report_march2012.pdf (*1755 MHz Report*).

¹² See CSMAC, *Framework for Work within CSMAC* (May 2012) available at http://www.ntia.doc.gov/files/ntia/meetings/framework_for_work_within_csmac_20120525.pdf (*CSMAC Framework*).

¹³ See *Tax Relief Act* §§ 6701-6702, 126 Stat. 245-255. Congress established the Spectrum Relocation Fund in 2004 in the Commercial Spectrum Enhancement Act to provide incentives and financial assistance to facilitate the relocation of eligible federal agencies from reallocated bands that are auctioned by the FCC. See Pub. L. No. 108-

reallocation of 15 megahertz from the 1675-1710 MHz band.¹⁴ This legislation further required that NTIA evaluate spectrum sharing technologies and solutions in connection with the potential operation of unlicensed devices in the 5350-5470 MHz and 5850-5925 MHz bands.¹⁵

The *2013 Presidential Memorandum* established a Spectrum Policy Team (SPT) to, among other tasks, address spectrum sharing between federal and non-federal users.¹⁶ The memorandum further directs NTIA to include in this *Fourth Interim Progress Report* a plan for federal agencies to provide a “quantitative assessment” of the agencies’ actual use of spectrum in those spectrum bands that NTIA previously identified and prioritized in its *Third Interim Report* and bands that NTIA and the SPT identify, based on their potential for non-federal use.¹⁷ Each agency must submit its assessment to NTIA and the SPT within twelve months after NTIA releases the plan.¹⁸

494, Title II, 118 Stat. 3991 (Dec. 23, 2004), available at <http://www.gpo.gov/fdsys/pkg/PLAW-108publ494/pdf/PLAW-108publ494.pdf>. See also *Ten-Year Plan* at 16-17 (recommending CSEA reforms that would not only provide additional funds for better equipment to support federal agencies’ mission-critical communications systems and reduce transition timeframes, but would also produce more efficient use of spectrum through sharing options, reduce long-run costs and increase auction proceeds).

¹⁴ See *Tax Relief Act* § 6401(a), 126 Stat. 222.

¹⁵ *Id.* § 6406(b), 126 Stat. 231.

¹⁶ See *2013 Presidential Memorandum* at § 1.

¹⁷ See *id.* at § 3(a).

¹⁸ *Id.*

2. ACTIVITIES AND ACCOMPLISHMENTS

Since October 1, 2012, NTIA, the FCC, and the participant federal agencies of the PPSG have endeavored to achieve the President’s goal of making 500 megahertz of spectrum available for wireless broadband according to the *Ten-Year Plan*. During this period, NTIA chaired three meetings of the PPSG and twelve meetings of the PPSG’s Spectrum Working Group. Table 2-1 provides an updated list of the spectrum bands that NTIA, in conjunction with the PPSG, has identified for continued investigation for potential repurposing.

Table 2-1 Federal and Shared Spectrum Bands Under Investigation		
Frequency Band**** (MHz)	Amount (megahertz)	Current allocation/usage
406.1-420**	13.9	Federal
1300-1390**	90	Federal
1675-1710*	35	Federal/non-federal shared
1755-1780***	25	Federal
1780-1850****	70	Federal
2700-2900**	200	Federal
2900-3100	200	Federal/non-federal shared
3100-3500	400	Federal/non-federal shared
3500-3650*	150	Federal
4200-4400** [4200-4220 & 4380-4400]	200	Federal/non-federal shared
5350-5470	120	Federal/non-federal shared
5850-5925	75	Federal/non-federal shared
Total	1578.9	

* Parts of these bands recommended for reallocation in the *Fast Track Report*.

** Bands obligated by U.S.-Canada or U.S.-Mexico bilateral agreement(s) and will require international consideration if repurposed.

*** While the *1755-1850 MHz Report* considered the 1755-1850 MHz band in its entirety, the upcoming AWS-3 auction will include the 1755-1780 MHz portion of this band as described below.

**** The 2200-2290 MHz band has been removed from further consideration because studies indicate that high-density terrestrial mobile operations would cause significant interference to satellite receivers in this band.

The following subsections provide an update on activities that occurred during the October 1, 2012 to September 30, 2013 reporting period including:

1. Collaborative efforts to develop sharing arrangements in the 1695-1710 MHz and 1755-1780 MHz bands;
2. Federal agency transition planning for relocation and spectrum sharing in these bands;
3. Analysis toward accommodating U-NII devices in the 5 GHz band;
4. Development of a plan for quantitative assessment of federal agency operations in certain frequency bands;
5. Recent and ongoing FCC activities;

6. Reevaluation and reprioritization of bands under consideration for relocation or sharing; and
7. Related international regulatory activities.

1695-1710 MHz and 1755-1850 MHz Collaborative Efforts

Based on the results of the *Fast Track Report's* recommendations on repurposing the 1695-1710 MHz band and NTIA's March 2012 *1755 MHz Report* on the viability of accommodating commercial wireless broadband in the 1755-1850 MHz band, the CSMAC formed five working groups as a means for federal agency representatives and industry experts to collaborate on the development of relocation and sharing solutions in these frequency bands.¹⁹ The groups analyzed the sharing potential between wireless broadband devices using the Long Term Evolution (LTE) standard and federal agency operations.²⁰

One working group addressed the 1695-1710 MHz band, while the other four groups focused on different federal operations in the 1755-1850 MHz band, as described in the following sections. Agency and industry representatives served as co-chairs and participants for the groups, while NTIA and FCC staff and CSMAC member liaisons observed and, when necessary, assisted working group activities.

The working groups collected and analyzed technical and operational information on LTE and federal systems, assessed the potential for sharing among these systems, developed recommendations, and prepared reports documenting their findings and recommendations for the CSMAC. The CSMAC adopted the reports of the working groups, thereby providing them to NTIA as potential recommendations to the FCC in its AWS-3 rulemaking proceeding. NTIA endorsed the recommendations contained in the initial *Working Group 1 Report* and the final *Working Group 2 Report* and transmitted them to the FCC in an April 2013 letter.²¹

¹⁹ See *CSMAC Framework*.

²⁰ One of the working groups organized a collaborative effort between industry and government experts to develop realistic technical and operational parameters for the LTE systems, which all working groups used in their sharing studies. See CSMAC, *Final Report, Working Group 1—1695-1710 MHz Meteorological-Satellite, Rev. 1* (July 23, 2013) at 1, Appendix 3, available at http://www.ntia.doc.gov/files/ntia/publications/wg1_report_07232013.pdf (*Working Group 1 Report*). The working groups considered LTE transmissions only in the user equipment-to-base station (uplink) direction in these bands, in accordance with the proposed configuration.

²¹ See Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information, U.S. Department of Commerce, to Julius Genachowski, Chairman, FCC (Apr. 19, 2013), available at http://www.ntia.doc.gov/files/ntia/publications/ntia_letter_to_fcc_chair_re_1695_and_1755_auction_20130419.pdf. Working Group 1 subsequently updated its report. On November 25, 2013, NTIA transmitted to the FCC its endorsement of the recommendations contained in the updated Working Group 1 report and the final reports from Working Groups 3, 4, and 5, see Letter from Karl B. Nebbia, Assoc. Admin. Office of Spectrum Mgt., NTIA, to Julius Knapp, Chief, Office of Eng. and Tech., FCC (Nov. 25, 2013), available at http://www.ntia.doc.gov/files/ntia/publications/ntia_aws-3_itr_11252013_.pdf.

The CSMAC working group approach broke new ground in industry/government collaboration and information sharing, which are critical components of decision-making regarding spectrum repurposing. This experience demonstrated how spectrum sharing requires a new way of doing business that involves early and sustained collaboration between industry stakeholders and affected federal agencies. The effort has allowed all parties to gain a better understanding of the different federal systems and the proposed commercial deployments in the bands tagged for repurposing and will facilitate commercial entry into the 1695-1710 MHz and 1755-1780 MHz bands after the auction.

Industry and government participants had a significant challenge in developing a framework to share sensitive information on a timely basis. Progress of the working groups was delayed as the parties negotiated and sought approval of formal non-disclosure agreements. Another challenge involved the groups' efforts to achieve consensus on the technical parameters, assumptions, and methodologies for conducting the analysis of potential interference. Recognition of these and other key challenges and their lessons learned will be helpful for future collaborative efforts. NTIA is grateful for the support and effort of all of the government and industry participants.

Working Group 1: 1695-1710 MHz Meteorological-Satellite Links

The *Tax Relief Act* required that the Secretary of Commerce submit a report to the President identifying 15 megahertz of spectrum in the 1675-1710 MHz band for reallocation from federal use to non-federal use.²² Reaffirming NTIA's conclusion in its *Fast Track Report* that the FCC should repurpose the 1695-1710 MHz band for wireless broadband use on a shared basis, the Secretary of Commerce recommended this action in a February 2013 report to the President.²³

CSMAC Working Group 1 considered potential interference from LTE systems to meteorological-satellite earth station receivers. Based on its studies, the working group recommended the establishment of "Protection Zones" around earth stations within which an LTE system could operate after successful coordination, ensuring that the commercial LTE operations would meet specified conditions such that they would not cause harmful interference to the earth station receivers.²⁴ The working group also recommended that the Federal Government consider assessing the feasibility of moving earth stations away from the most heavily populated areas, or take other actions to maximize commercial use of the band.²⁵

²² *Tax Relief Act*, § 6401(a)(3).

²³ *1675-1710 MHz Report*.

²⁴ See *Working Group 1 Report* at 6.

²⁵ Working Group 1 did not have sufficient time to study this issue, but recommends that "consideration may be

Working Group 2: 1755-1850 MHz Short-Distance Video Links

CSMAC Working Group 2 considered priorities for relocating short-range video links that federal agencies operate for law enforcement surveillance purposes and for land robotic systems.²⁶ Based on the availability of funding and comparable spectrum, the agencies intend to relocate these systems from the 1755-1780 MHz band within five years and from the 1780-1850 MHz band within ten years.²⁷ Seven of the thirteen federal agencies that conduct such video operations participated in the working group.²⁸

A sub-group of Working Group 2, comprised of industry participants, developed a list prioritizing the geographic areas from which video surveillance systems would be relocated, based on industry priorities for deploying broadband wireless systems.²⁹ The working group recommended that the agencies consider this prioritization in developing their transition plans for video surveillance systems, but it also recognized that the agencies will need to establish their timelines for clearing based on their operational requirements, which in some cases may require clearing larger geographic areas.³⁰

Working Group 3: 1755-1850 MHz Satellite Control and Electronic Warfare

Since federal agency satellite operations in the 1761-1842 MHz band segment and electronic warfare operations throughout the band will need to continue indefinitely, Working Group 3 focused on conditions for ongoing sharing between these government systems and wireless broadband operations.³¹ The working group made several recommendations to improve coordination processes between the Department of Defense (DOD) and commercial wireless service providers so that DOD can continue to successfully perform electronic warfare research, training, and other functions on the condition of not causing harmful interference to commercial LTE operations.³²

given to determine the merit of conducting this analysis prior to establishing rules for an auction to establish the feasibility, anticipated costs, and estimated timelines of relocating receive sites to remote locations and backhauling data to the facility where analysis of the data is performed.” *See Id.* at 7.

²⁶ *See* CSMAC, *Working Group 2: 1755-1850 MHz, Law Enforcement Surveillance, Explosive Ordnance Disposal, and Other Short Distance Links Final Report* (Jan 4, 2013) at 4-5, available at http://www.ntia.doc.gov/files/ntia/publications/csmac_wg-2_final_report_jan-4-2012.pdf.

²⁷ *Id.* at 6.

²⁸ *Id.* at 5.

²⁹ *Id.* at 6. The sub-group used the 176 Bureau of Economic Analysis Economic Areas (available at <http://transition.fcc.gov/oet/info/maps/bea/>) as the geographic areas.

³⁰ *Id.* at 12.

³¹ CSMAC, *Working Group 3: Report on 1755-1850 MHz Satellite Control and Electronic Warfare* (July 19, 2013), available at http://www.ntia.doc.gov/files/ntia/working_group_3_final.pdf.

³² *Id.*

Regarding Earth-to-space links for satellite control, the working group considered potential interference both from aggregated LTE user equipment transmitters to command uplink receivers on satellites and from earth station command uplinks to LTE base station receivers, concluding that LTE operations and satellite uplinks can successfully share the band. In the former case, Working Group 3 determined that, with few possible exceptions, an aggregate power flux density level of -179 dBW/Hz/m² at any location in the geostationary orbit, considering all visible mobile and hand-held devices, would represent a “safe” level of interference for a satellite in any orbit.³³ The working group also found that the small percentage of time the earth stations would transmit in the 1761-1780 MHz range and the small signal bandwidth would make harmful interference to the LTE base stations unlikely. The group also identified technologies and techniques that would further mitigate interference to the LTE base stations, concluding that the satellite control operations could successfully share with LTE systems in the band.³⁴

Working Group 4: 1755-1850 MHz Tactical Radio Relay, Fixed Microwave, and Software Defined Radios

Working Group 4 addressed compatibility of three types of federal ground-based radio systems with the proposed LTE systems.³⁵ For fixed point-to-point microwave systems, the working group recommended relocation to alternative frequency bands, since the required commercial technology is readily available and relocation costs are low, assuming favorable site conditions.³⁶

In analyzing tactical radio relay (TRR) and the Joint Tactical Radio System (JTRS), however, the group’s limited analyses found that these systems could only operate compatibly with LTE systems if separated by distances of hundreds of kilometers.³⁷ The working group recommended that the TRRs be relocated from the 1755-1780 MHz band to the 1780-1850 MHz band or to other alternative spectrum bands. However, TRRs would continue to operate in the 1755-1780 MHz band at high-priority training areas from which relocation is not feasible, and in areas with little or no expected LTE deployment, subject to a sharing approach to be developed for this purpose.³⁸ JTRS would be relocated to the 1780-1850 MHz band except for systems at

³³ *Id.* at 2.

³⁴ *Id.*

³⁵ CSMAC, *Working Group 4: 1755-1850 MHz Point-to-Point Microwave Tactical Radio Relay (TRR) Joint Tactical Radio System / Software Defined Radio (JTRS/SDR) Final Report* (July 24, 2013), available at http://www.ntia.doc.gov/files/ntia/publications/wg4_final_report_072413.pdf.

³⁶ *Id.* at 11.

³⁷ *Id.* at 3. Working Group 4 studied JTRS as an example of an SDR system. *Id.* at 9.

³⁸ *Id.* at 14-15.

six high-priority training locations.³⁹

Working Group 5: 1755-1850 MHz Airborne Operations

Working Group 5 considered a variety of airborne systems including aeronautical mobile telemetry, small unmanned aircraft systems, the Air Combat Training System, precision-guided munitions, and other airborne data link systems. As with Working Group 4, the results of the Working Group 5 analyses found separation distances of hundreds of kilometers would be necessary for sharing with LTE systems, based on its initial analyses. Working Group 5 did not reach specific recommendations for sharing, but it made recommendations regarding further analysis.⁴⁰

CSMAC Consideration of Working Group Reports

The membership of the full CSMAC considered and adopted the final report of Working Group 1 at its July 24, 2013 meeting, the report of Working Group 2 at its February 21, 2013 meeting, and the reports of Working Groups 3, 4, and 5 at its August 28, 2013 meeting.⁴¹ At the August meeting, various CSMAC members issued three separate statements. One statement expressed concern with the published analyses of Working Groups 3, 4, and 5, characterizing them as “conservative” and “limited,” and representing only a “first step.” It characterized the results as not representing “the real-world interference environment” and proposed that additional analytical efforts could reduce the size of the protection zones for federal systems.⁴² A second statement suggested that the working groups had not given sufficient consideration to the possibility of relocating federal operations from the 1755-1780 MHz band. It asked whether some federal operations could relocate, how much of the 1755-1780 MHz band could be cleared, and in how much time, and at what cost, some or all of the federal operations could relocate.⁴³ A third statement characterized the CSMAC studies in the 1755-1780 MHz band as “a good faith

³⁹ *Id.* at 16-17.

⁴⁰ CSMAC, *Working Group 5 (WG-5) 1755-1850 MHz Airborne Operations (Air Combat Training System, Small Unmanned Aircraft Systems, Precision-Guided Munitions, Aeronautical Mobile Telemetry) Final Report* (July 23, 2013), available at http://www.ntia.doc.gov/files/ntia/publications/wg5_final_report_7-22_dfo.pdf.

⁴¹ See CSMAC, *Minutes of the CSMAC Meeting on July 24, 2013* at 68, available at <http://www.ntia.doc.gov/files/ntia/publications/0221ntia.pdf>. The CSMAC had adopted an earlier version of the *Working Group 1 Report* at its February 21, 2013 meeting, but Working Group 1 had subsequently made revisions; see CSMAC, *Minutes of the CSMAC Meeting on Feb. 21, 2013* at 43-44, available at <http://www.ntia.doc.gov/files/ntia/publications/0221ntia.pdf>; see CSMAC, *Minutes of the CSMAC Meeting on Aug. 28, 2013* at 42, 42, and 12, respectively, available at http://www.ntia.doc.gov/files/ntia/publications/0828csmac_508_compliant.pdf.

⁴² See CSMAC, *Separate Statement Concerning Working Group Reports for the 1755-1850 MHz Band Rev 1* (Aug 29, 2013), available at http://www.ntia.doc.gov/files/ntia/publications/csmac_separate_statement-aug_29-rev2.pdf. Other CSMAC members joined each of the three separate statements.

⁴³ CSMAC, *Separate Statement, Harold Furchtgott-Roth, Member CSMAC* (Aug. 2013), available at http://www.ntia.doc.gov/files/ntia/publications/furchtgott-roth-csmac_statement_080713_3.pdf.

effort” despite extreme budgetary challenges, and suggested that the conclusion that sharing is difficult “should surprise no one.”⁴⁴

Other Proposals for the 1755-1780 MHz Band

In a letter to the FCC dated June 24, 2013, a group of wireless industry representatives presented a proposal for mobile broadband access to the 1755-1780 MHz band. In considering the entire 1755-1850 MHz band, the proposal would make 1755-1780 MHz available first, but would also address the 1780-1850 MHz segment of the band.⁴⁵ A July 17, 2013 letter from DOD’s Chief Information Officer to the Assistant Secretary of Commerce for Communications and Information provided details for an alternative proposal to modify certain systems to operate in the 1780-1850 MHz band, the 2025-2110 MHz band, and several other existing federal bands. This proposal is expected to significantly enhance the industry’s ability to successfully deploy new mobile systems in the 1755-1780 MHz band, reduce the impact of such deployment on federal systems, and reduce estimated transition periods and costs.⁴⁶

CSEA Implementation and Transition Planning

New and revised provisions of the CSEA enacted as part of the *Tax Relief Act* in 2012 expanded the types of relocation and sharing costs for which affected federal entities can receive payment from the Spectrum Relocation Fund. These include the costs of planning or managing a relocation or sharing arrangement, research, engineering studies, and economic analyses reasonably incurred in connection with estimating relocation or sharing costs, determining feasibility of relocation, or planning for or managing a relocation or sharing arrangement. The changes to the CSEA also required NTIA to establish a Technical Panel – comprised of members appointed by NTIA, the FCC and the Office of Management and Budget (OMB), procedures for a Dispute Resolution Board, and a common format for federal agency transition plans.⁴⁷ In addition, the *Tax Relief Act* authorized OMB to make transfers to eligible federal entities from the Spectrum Relocation Fund to pay for relocation or sharing costs related to certain pre-auction activities.⁴⁸

⁴⁴ CSMAC, *Separate Statement of Janice Obuchowski* (Aug 2, 2013), available at http://www.ntia.doc.gov/files/ntia/publications/obuchowski_csamc_statement_5aug2013.pdf.

⁴⁵ See Letter from Steve Sharkey, T-Mobile U.S., Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket Nos. 10-123, 07-195 (June 24, 2013), at Attachment, *Industry Roadmap to Assessing the 1755-1850 MHz Band*.

⁴⁶ See Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA, to Julius P. Knapp, Chief, Office of Engineering and Technology, FCC (July 22, 2013) (*NTIA July 2013 Letter*); see also *id.*, Enclosure 1 (Letter from Teresa M. Takai, Chief Information Officer, DoD, to Lawrence E. Strickling, Assistant Secretary for Communications and Information, NTIA, U.S. Dept. of Commerce (July 17, 2013)).

⁴⁷ *Tax Relief Act* § 6701, 126 Stat. 245-252.

⁴⁸ *Id.* § 6702, 126 Stat. 252-55.

In January 2013, NTIA released regulations governing the workings of the Technical Panel and the dispute resolution process, which Congress established to facilitate the relocation of federal operations or spectrum sharing with non-federal auction winners.⁴⁹ In May 2013, NTIA released a new edition of its Manual of Regulations and Procedures for Federal Radio Frequency Management, which included a revision of Annex O, *Relocation or Sharing by Federal Government Stations in Support of Reallocation*.⁵⁰ The revised annex provides guidance and outlines procedures for developing federal agency transition plans. The annex includes a generic common format for the agencies to use for their transition plans, which may be updated or supplemented to reflect band- or service-specific information and guidance in connection with particular eligible frequencies.

The transition planning process for the 1695-1710 MHz and 1755-1780 MHz bands is well underway. On March 20, 2013, the FCC notified NTIA that it intended to commence an auction of licenses in the 1695-1710 MHz band and 1755-1780 MHz band as early as September 2014.⁵¹ Subsequently, the FCC proposed rules for making the 1695-1710 MHz, 1755-1780 MHz, 2020-2025 MHz, and 2155-2180 MHz bands (collectively, AWS-3) available for commercial use.⁵² The *Tax Relief Act's* changes to the CSEA provide that each federal entity must submit its transition plan to NTIA and the Technical Panel no later than 240 days prior to the auction start date.⁵³ Accordingly, NTIA notified the federal agencies that they should plan for a September 20, 2014 auction start date for the 1695-1710 MHz and 1755-1780 MHz bands, which means that each affected agency must formally submit to NTIA and the Technical Panel a complete transition plan no later than January 23, 2014. Then, the Technical Panel will submit to NTIA and to the federal entity a report on the sufficiency of the transition plan within 30 days after the submission of the plan.⁵⁴ NTIA must make the transition plans, with the exception of classified or other sensitive information, publicly available on its website no later than 120 days

⁴⁹ NTIA, *Relocation of and Spectrum Sharing by Federal Government Stations – Technical Panel and Dispute Resolution Boards*, Final Rule, Docket No. 120620177-2445-02, 78 Fed. Reg. 5310 (Jan 25, 2013), available at <http://www.gpo.gov/fdsys/pkg/FR-2013-01-25/pdf/2013-01564.pdf> (*Technical Panel Rules*).

⁵⁰ NTIA, *Manual of Regulations and Procedures for Federal Radio Frequency Management* (May 2013 Edition) at Annex O, *Relocation or Sharing by Federal Government Stations in Support of Reallocation*, available at <http://www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federal-radio-frequency-management-redbook> (*NTIA Manual*).

⁵¹ Letter from Julius Genachowski, Chairman, Federal Communications Commission, to Lawrence E. Strickling, Assistant Secretary for Communications and Information, National Telecommunications and Information Administration (Mar. 20, 2013) available at <http://go.usa.gov/2VR5>.

⁵² See *infra*.at 20.

⁵³ See 47 U.S.C. § 923(h)(1).

⁵⁴ See *id.* § 923(h)(4)(A); see also *Technical Panel Rules*. If the Technical Panel finds that a federal entity's plan is "insufficient," the Technical Panel informs the affected federal entity and such entity has up to 90 days to submit a revised plan to NTIA and the Technical Panel. The panel would then have 30 days during which to determine whether the revised plan is sufficient. See *Id.* at § 301.120, 78 Fed. Reg. at 5316-17.

before the start date of the auction.⁵⁵

Pursuant to the CSEA, in August 2013, NTIA published a *Notice of Inquiry* seeking public input on the common format to be used for the eligible frequencies in these bands.⁵⁶ The four sets of comments provided to NTIA in response to the *Notice* focused on information and processes.⁵⁷ The commenters emphasized that potential bidders need sufficient technical and operational information on federal systems to accurately determine the value of licenses. This includes adequate granularity of geographic operations information, details on agency protection zones, and information on risk factors that could delay implementation. Process concerns included validation of agency information, data formats that facilitate automated analysis, coordination between potential bidders and agencies, and the use of “trusted agents” to make classified and sensitive information available to potential bidders.

To assist affected agencies with transition planning, NTIA established a Transition Plan Working Group made up of agency representatives. The group provides a forum for NTIA, OMB, FCC, and the agencies to exchange information on what additional guidance may be necessary and how to resolve transition planning issues they have identified.

5350-5470 MHz and 5850-5925 MHz Bands

In January 2013, NTIA published an initial study of 195 megahertz of spectrum in the 5 GHz range for U-NII devices.⁵⁸ The study, in response to the *Tax Relief Act*, evaluates known and proposed spectrum sharing technologies and the risk to federal users if U-NII devices were allowed to operate in these bands. The report concludes that further analysis is required on the mitigation of risk factors. The *Tax Relief Act* also required that the FCC begin a proceeding to allow U-NII devices to operate in the 5350-5470 MHz band.⁵⁹ In response, the FCC released a Notice of Proposed Rulemaking (NPRM) in February 2013 proposing to make both the 5350-5470 MHz and 5850-5925 MHz bands available for U-NII device operation, while also modifying rules in 100 megahertz of existing 5 GHz unlicensed spectrum.⁶⁰ NTIA, in

⁵⁵ See 47 U.S.C. § 923(h)(5).

⁵⁶ NTIA, *Common Format for Federal Entity Transition Plans*, Notice of Inquiry, Docket No. 130809701–3701–01, 78 Fed. Reg. 50396 (Aug. 19, 2013), available at <http://www.gpo.gov/fdsys/pkg/FR-2013-08-19/pdf/2013-20149.pdf>.

⁵⁷ The comments submitted on September 18, 2013 by CTIA-The Wireless Association, Mobile Future, T-Mobile USA, Inc., AT&T Inc., and Verizon Wireless (joint), and Comsearch are available at <http://www.ntia.doc.gov/federal-register-notice/2013/comments-common-format-federal-entity-transition-plans>.

⁵⁸ NTIA, *Evaluation of the 5350-5470 MHz and 5850-5925 MHz Bands Pursuant to Section 6406(b) of the Middle Class Tax Relief and Job Creation Act of 2012* (Jan. 25, 2013), available at http://www.ntia.doc.gov/files/ntia/publications/ntia_5_ghz_report_01-25-2013.pdf (5 GHz Report).

⁵⁹ See *Tax Relief Act* at § 6406(b).

⁶⁰ See Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band, ET Docket No. 13-49, *Notice of Proposed Rulemaking* (Feb. 20, 2013) (5 GHz

cooperation with federal and commercial interests and the FCC, is working in support of the Department of State's International Telecommunication Advisory Committee (ITAC) to further develop technical analysis of sharing techniques and potential mitigation requirements for the 5350-5470 MHz band. This work also supports technical studies in preparation for the 2015 World Radiocommunication Conference (WRC-15).⁶¹

Initial federal agency studies in the 5350-5470 MHz band indicate that U-NII devices would be compatible with spaceborne synthetic aperture radar (SAR) systems in this band, provided that the U-NII devices operate mainly indoors, and that they employ certain other interference mitigation measures, including limits on power radiated in directions above the horizon. Studies assuming the use of these and other interference mitigation techniques, however, indicate that U-NII operations would not be compatible with airborne, ground-based and maritime radars. Reducing the U-NII device radiated power in this band to levels necessary for compatibility with federal radar systems would greatly reduce the range of the U-NII devices, unless these devices also operate in nearby frequency bands where radiated power is less constrained—a capability included in the pertinent industry standard. Domestic efforts to accommodate U-NII devices in the 5350-5470 MHz band, therefore, center on developing and validating interference mitigation techniques that U-NII devices would employ to protect federal radars, while maintaining the desired U-NII device operating range.⁶²

With respect to the 5850-5925 MHz band, instead of expending resources on traditional interference analysis that would certainly show the potential for harmful interference to other authorized users of Dedicated Short-Range Communications (DSRC) systems, NTIA encouraged U-NII device manufacturers and representatives of the automobile industry to consider ways for their technologies to be interoperable, work cooperatively, or otherwise coexist with each other. NTIA continues to monitor discussions between auto industry and U-NII stakeholders in a working group of the Institute of Electrical and Electronics Engineers (IEEE) 802 standards committee. The IEEE 802.11 working group provides an international multi-stakeholder forum

NPRM). The *Tax Relief Act* provides that the FCC may only take action to allow unlicensed U-NII devices to operate in the 5350-5470 MHz band if, in consultation with NTIA, it determines that “licensed users will be protected by technical solutions, including use of existing, modified, or new spectrum sharing technologies and solutions, such as dynamic frequency selection” and “the primary mission of Federal spectrum users in the 5350-5470 MHz band will not be compromised by the introduction of unlicensed devices.” See *Tax Relief Act* at § 6406(a)(2).

⁶¹ See *5 GHz Report* at iii. Industry stakeholders include representatives of the wireless industry and the intelligent transportation community.

⁶² ITU, Radiocommunication Sector, U.S. contribution to Joint Task Group 4-5-6-7, *Compatibility Studies Between Radio Local Area Network (RLAN) Systems and Aeronautical Airborne Radar Systems in the 5 350-5 460 MHz Band*, Document 4-5-6-7/166, (July 16, 2013), available at <http://www.itu.int/md/R12-JTG4567-C-0166/en>, ITU, Radiocommunication Sector, U.S. contribution to Joint Task Group 4-5-6-7, *Compatibility Studies Between Radio Local Area Network (RLAN) Systems and EESS (Active) Synthetic Aperture Radar (SAR) Systems in the 5 350-5 470 MHz Band*, Document 4-5-6-7/167, (July 15, 2013), available at <http://www.itu.int/md/R12-JTG4567-C-0167/en>.

that has already developed standards for both wireless local area networks and vehicular wireless communications. The meetings of the 802.11 DSRC Coexistence Tiger Team have been productive and hold significant potential for successful collaboration and broad international implementation in this area.

Plan for Quantitative Assessments of Spectrum Usage

As noted above, the *2013 Presidential Memorandum* directs NTIA, in consultation with the SPT and appropriate agencies, to include in this report a “plan directing applicable agencies to provide quantitative assessments of the actual usage of spectrum” in prioritized bands from the *Third Interim Report* and in “such other bands as NTIA and the SPT determine have the greatest potential to be shared with nonfederal users.”⁶³ Appendix A to this report contains the *Plan for Quantitative Assessments of Spectrum Usage*.

In summary, the plan calls for the quantitative assessment of 960 megahertz of spectrum allocated for exclusive federal use or shared federal/non-federal use that NTIA previously identified for potential repurposing. In developing this plan, NTIA and the SPT considered whether additional bands should be assessed based on their potential to be shared with non-federal users, the number and nature of federal and non-federal systems, the technical suitability of the band, international implications, and the potential for relocating federal systems to comparable spectrum or otherwise enabling comparable capabilities.⁶⁴ In light of the thorough evaluation and reevaluation of over 1,500 megahertz of spectrum since the release of the *Ten-Year Plan* and the reprioritization of selected bands set forth below, the bands shown in Table 2-2 will be subject to the quantitative assessments:

Table 2-2 Spectrum Bands Subject to Quantitative Assessment	
Frequency Band (MHz)	Amount (megahertz)
1300-1390	90
1675-1695	20
2700-2900	200
2900-3100	200
3100-3550	450
Total	960

The plan requires agencies to verify system characteristics associated with their frequency assignments to enable calculation of the geographic coverage area used by these

⁶³ *2013 Presidential Memorandum* at § 3(a).

⁶⁴ *Id.* In accordance with Section 3(d) of the *2013 Presidential Memorandum*, each agency’s regular five- and ten-year assignment reviews will also include quantitative assessments of the actual usage of spectrum for assignments in other bands. *Id.* at § 3(d).

systems. The plan further requires each agency to provide the time of use, which together with the coverage area and other metrics, yields a more accurate approximation of the extent to which each system uses its assigned spectrum. The cumulative total of each agency's uses within a range of frequencies and across systems will serve as its quantitative assessment for the particular band under review. In bands and locations where multiple agencies have systems, NTIA will aggregate this data in the summary called for by the *2013 Presidential Memorandum*.

In addition, agencies will provide information on projected increases in spectrum usage and needs. They will also identify where access to non-federal spectrum could aid in fulfilling agency missions. Finally, the plan includes a schedule for validating current assignment data and for delivering draft and final quantitative assessments to NTIA and the SPT. The agencies will have twelve months from the release of the plan to submit their final assessments.

The information developed in these assessments will help NTIA and the SPT, in consultation with agencies and other stakeholders, determine the extent to which spectrum assigned to the agencies could be further evaluated for sharing with commercial users, particularly in major metropolitan areas. Pursuant to Section 3(b) of the memorandum, NTIA shall release a summary of the assessments publicly to the extent consistent with law and existing safeguards for protecting classified, sensitive, and proprietary data. NTIA and the SPT will also make any appropriate recommendations regarding the possible availability of spectrum in the subject bands for innovative and flexible commercial uses, including broadband, taking into account factors such as the nature of the federal systems in the bands and the extent to which the quantitative assessments reveal how those systems occupy and use these bands.

FCC Activities

The FCC has also taken significant steps to make 500 megahertz of spectrum available for broadband by 2020.⁶⁵ Since the release of the *Third Interim Report*, the FCC has:

- Created service, licensing, and technical rules for 10 megahertz of spectrum in the 1915-1920 MHz and 1995-2000 MHz bands (H Block), and established procedures to auction the spectrum beginning in January 2014;
- Authorized the terrestrial use of 40 megahertz of spectrum in the 2000-2020 MHz and 2180-2200 MHz bands (AWS-4);
- Proposed to make 100 megahertz of spectrum available in the 3550-3650 MHz band for

⁶⁵ As summarized in the *Third Interim Report*, the FCC modified its rules in October 2012 to facilitate wireless broadband deployment in 30 megahertz of spectrum from the 2305-2320 MHz and 2345-2360 MHz WCS bands. See *Third Interim Report* at 10-11; Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band, WT Docket 07-293 and IB Docket No. 95-91, *Order on Reconsideration*, 27 FCC Rcd 13651 (2012).

introducing small cell and other technologies on shared basis with incumbent federal and commercial users;

- Initiated a rulemaking proposing to make a number of bands available for flexible use wireless services, including 1695-1710 MHz, 1755-1780 MHz, 2020-2025 MHz, and 2155-2180 MHz;
- Continued working toward implementation of the incentive auction authority granted by Congress to repurpose broadcast spectrum on a voluntary basis for flexible use wireless services, including mobile broadband; and
- Initiated a proceeding to make an additional 195 megahertz of spectrum available for unlicensed use in the 5 GHz band while proposing changes to the rules for 100 megahertz in existing 5 GHz U-NII bands to permit deployment of a new generation of wider bandwidth devices.

AWS-4 and H Block

On December 17, 2012, the FCC released a *Report and Order* establishing service and technical rules for terrestrial wireless broadband use of the 2000-2020 MHz and 2180-2200 MHz bands.⁶⁶ The *AWS-4 Report and Order* aimed to maximize the utility of the spectrum, consistent with the public interest, by enabling stand-alone flexible use terrestrial service in the 2 GHz mobile-satellite service band. To maximize the productive use of spectrum in the AWS-4 bands, the FCC adopted performance requirements that require the licensee to provide coverage and offer service to 40 percent of the aggregate population of its license area within four years, and 70 percent of the population in each Economic Area within seven years.⁶⁷ The *AWS-4 Report and Order* also included technical rules to protect the future use of the adjacent 1995-2000 MHz, for which the FCC proposed rules in the companion H Block proceeding.⁶⁸

On June 27, 2013, the FCC released a *Report and Order* establishing service, technical, and licensing rules for flexible use wireless services in the 1915-1920 MHz and 1995-2000 MHz bands.⁶⁹ The *H Block Report and Order* took the first step toward implementing the congressional directive in the *Tax Relief Act* to grant new initial licenses for this 10 megahertz of

⁶⁶ Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands, WT Docket Nos. 12-70, 04-356, ET Docket No. 10-142, *Report and Order and Order of Proposed Modification*, 27 FCC Rcd 16102 (2012) (*AWS-4 Report and Order*).

⁶⁷ *Id.* at 16173-74 ¶¶ 187-188.

⁶⁸ *Id.* at 16127-45 ¶¶ 64-100. See Service Rules for the Advanced Wireless Services H Block—Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 MHz bands, WT Docket No. 12-357, *Notice of Proposed Rulemaking*, 27 FCC Rcd 16258 (2012) (*H Block NPRM*).

⁶⁹ Service Rules for the Advanced Wireless Services H Block—Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 MHz Bands, WT Docket No. 12-357, *Report and Order*, 28 FCC Rcd 9483 (2013) (*H Block Report and Order*).

spectrum through a system of competitive bidding by February 2015.⁷⁰ Pursuant to a related requirement in the *Tax Relief Act*, the FCC's H Block technical rules ensure that the spectrum can be used without causing harmful interference to commercial licensees in the 1930-1950 MHz band.⁷¹ To maximize the productive use of the spectrum, the FCC adopted performance requirements that require licensees to provide coverage and offer service to 40 percent of the population in each license area within four years, and 75 percent of the population in each license area within ten years.⁷²

On September 13, 2013, the FCC's Wireless Telecommunications Bureau (WTB) announced procedures and deadlines for the H Block auction and established a reserve price of \$1.56 billion.⁷³ The proceeds from the auction will be the first spectrum auction proceeds deposited in the Public Safety Trust Fund established by the *Tax Relief Act*.⁷⁴

3.5 GHz

In December 2012, the FCC proposed making 100 megahertz of spectrum available for small cell use on a shared basis with federal and commercial incumbents in the 3.5 GHz band.⁷⁵ The *3.5 GHz NPRM* followed NTIA's *Fast Track Report* which identified the 3.5 GHz band for sharing, and a recommendation by the President's Council of Advisors on Science and Technology regarding shared use of the 3.5 GHz band for systems employing small cell technology and other technologies.⁷⁶

The *3.5 GHz NPRM* sought comment on the creation of a three-tiered licensing and access scheme managed by a dynamic database.⁷⁷ The first tier—Incumbent Access—would include only incumbent federal operations and incumbent Fixed Satellite Service operations. The second tier—Priority Access—would be open to critical use facilities such as hospitals and public safety facilities. The third tier—General Authorized Access—would be an open general access tier in which users could access the band on an opportunistic basis subject to protections

⁷⁰ See *Tax Relief Act* § 6401(b)(2)(A)-(B), 47 U.S.C § 1451(b)(2)(A)-(B).

⁷¹ See *id.* § 6401(b)(4), 47 U.S.C § 1451(b)(4).

⁷² *H Block Report and Order*, 28 FCC Rcd at 9558-59 ¶ 195.

⁷³ Auction of H Block Licenses in the 1915-1920 MHz and 1995-2000 MHz Bands Scheduled for January 14, 2014; Notice and Filing Requirements, Reserve Price, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 96, AU Docket No. 13-178, *Public Notice*, 28 FCC Rcd 13019 (WTB Sept. 13, 2013). Additional information is available at http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=96.

⁷⁴ See *Tax Relief Act* § 6401(c)(4) (47 U.S.C. § 309(j)(8)(F)).

⁷⁵ Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, *Notice of Proposed Rulemaking*, 27 FCC Rcd 15594 (2012) (*3.5 GHz NPRM*).

⁷⁶ See *Fast Track Report* at 1-4 to 1-8; PCAST, Report to the President: *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth* at 51 (July 2012), available at <http://go.usa.gov/k27R>.

⁷⁷ *3.5 GHz NPRM*, 27 FCC Rcd at 15612-15 ¶¶ 53-60.

of the other two tiers. The 3.5 GHz NPRM included a supplementary proposal to add an additional 50 megahertz to the band by incorporating 3650-3700 MHz, which is currently available for licensing on a non-exclusive nationwide basis.⁷⁸ The 3.5 GHz NPRM also sought comment on issues regarding coordinating with federal incumbents, and possible methods for reducing the exclusion zones proposed in NTIA's *Fast Track Report*.⁷⁹

In March 2013, the FCC held a workshop to explore a number of the ideas raised in the 3.5 GHz NPRM.⁸⁰ The goal of the workshop was to bring together top innovators and thinkers in the small cell, database management, and spectrum sharing fields to discuss technological developments. The workshop explored small cell technology in the context of the 3.5 GHz band as well as database and dynamic spectrum sharing technologies that could be utilized to manage access to the band.⁸¹

AWS-3

In July 2013, the FCC proposed rules for making the 1695-1710 MHz, 1755-1780 MHz, 2020-2025 MHz, and 2155-2180 MHz bands available for commercial use.⁸² Under the *Tax Relief Act*, the Secretary of Commerce must identify 15 megahertz of spectrum between 1675 megahertz and 1710 megahertz to be reallocated from federal to non-federal use.⁸³ The FCC must identify, reallocate, auction, and license, under flexible service rules, certain spectrum bands for commercial use. These bands include 2155-2180 MHz, an additional contiguous 15 megahertz to be identified by the FCC, the 15 megahertz between 1675 megahertz and 1710 megahertz identified by NTIA.⁸⁴

With respect to the AWS-3 bands that are allocated for federal use, including 1695-1710 MHz and 1755-1780 MHz, the AWS-3 NPRM was informed by the work completed in the

⁷⁸ *Id.* at 15620-22 ¶¶ 77-82. The 3650-3700 MHz band was reallocated from the Federal Government in response to the Omnibus Budget Reconciliation Act of 1993. See NTIA, *Spectrum Reallocation Final Report*, NTIA Special Publication 95-32 (Feb. 1995); Pub. L. No. 103-66, Title VI, 107 Stat. 312, 379 (Aug. 10, 1993).

⁷⁹ 3.5 GHz NPRM at 15629-36 ¶¶ 109-27.

⁸⁰ FCC Wireless Telecommunications Bureau and Office of Engineering and Technology Announce Agenda for Workshop on the 3.5 GHz Notice of Proposed Rulemaking, WT Docket No. 12-354, DA 13-367, *Public Notice*, 28 FCC Rcd 2251 (2013). An archived webcast of the workshop is available at <http://www.fcc.gov/events/35-ghz-workshop>.

⁸¹ In November 2013, the FCC issued a *Public Notice* seeking comment on a revised licensing framework and related technical issues, see Commission Seeks Comment on Licensing Models and Technical Requirements in the 3550-3650 MHz Band, GN Docket No. 12-354, *Public Notice*, 28 FCC Rcd 15300 (Nov. 2013).

⁸² See Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands, GN Docket No. 13-185, *Notice of Proposed Rulemaking and Order on Reconsideration*, 28 FCC Rcd 11479 (2013) (AWS-3 NPRM).

⁸³ *Tax Relief Act* § 6401(a)(3); 47 U.S.C § 1451(a)(3).

⁸⁴ *Id.* § 6401(b); 47 U.S.C § 1451(b).

CSMAC, and anticipated that final FCC action would be informed by the recommendations in the final CSMAC reports.⁸⁵ The *AWS-3 NPRM* sought comment on ways to facilitate government clearing and or sharing in the 1755-1780 MHz band, including the alternative solution proposed by DOD that would result in many incumbent systems vacating the band and some relocating to the 2025-2110 MHz band, which would be shared with incumbent federal users and non-federal licensees.⁸⁶ The FCC plans to develop service, licensing, and technical rules for AWS-3 in order to hold an auction and issue initial licenses by February 2015.

Broadcast Television Incentive Auction

The *Tax Relief Act* granted incentive auction authority to the FCC, which it is currently implementing.⁸⁷ Since the release of NTIA's *Third Interim Report*, the FCC developed a comprehensive record in response to the *Incentive Auction NPRM*. It has also issued several public notices and held a number of public workshops and webinars toward the development of broad policy and technical recommendations for conducting incentive auctions of the broadcast television bands.

During the reporting period for this report, the FCC's Incentive Auction Task Force has continued to plan for the television band repacking process to free up contiguous blocks of spectrum for mobile broadband use, worked with the broadcast and cable industries on transition planning and reimbursement issues, developed alternative band plan proposals, and conducted outreach and international coordination activities.⁸⁸ The new FCC Chairman expects the FCC to commence the incentive auction in the middle of 2015.⁸⁹

5 GHz

Currently, U-NII devices operate in 555 megahertz of spectrum in the 5 GHz band, and are used for Wi-Fi enabled local area networks to connect smart phones, tablets and laptops to the broadband network. This spectrum also supports broadband services offered by Wireless Internet Service Providers (WISPs), particularly in rural areas. The *Tax Relief Act* specifically directed NTIA to examine the potential for expanded unlicensed use in the 5 GHz band and for

⁸⁵ See *AWS-3 NPRM*, 28 FCC Rcd at 11480 ¶ 2.

⁸⁶ *Id.* at 11514-15 ¶ 79.

⁸⁷ *Tax Relief Act* § 6402; 47 U.S.C. § 309(j)(8)(G). See Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Docket No. 12-268, *Notice of Proposed Rulemaking*, 27 FCC Rcd 12357 (2012) (*Incentive Auction NPRM*). In response to the *NPRM*, over 400 interested parties filed comments. See GN Docket No. 12-268.

⁸⁸ See, e.g., Incentive Auction Task Force Update (Aug. 9, 2013), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-322743A1.pdf; Incentive Auction Task Force Update (June 27, 2013), available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0627/DOC-321880A1.pdf.

⁸⁹ See *Incentive Auction NPRM* at 12362 ¶ 10; Wheeler, Tom, FCC Chairman, *The Path to a Successful Incentive Auction* (Dec. 6, 2013), available at <http://www.fcc.gov/blog/path-successful-incentive-auction-0>.

the FCC to initiate a rulemaking in this regard.⁹⁰ In February 2013, the FCC issued the *5 GHz NPRM* which proposed to make an additional 195 megahertz of spectrum available for unlicensed use in the 5 GHz band (a 35 percent increase).

The FCC also proposed to revise and streamline its regulations to facilitate more robust use of 100 megahertz of the existing 5 GHz unlicensed, but noted that NTIA and certain federal agencies had identified the 5150-5250 MHz band as a comparable band to relocate aeronautical mobile telemetry systems to accommodate commercial wireless broadband services in the 1755-1850 MHz band.⁹¹ Subsequently, NTIA submitted to the FCC the DOD alternative proposal that would remove from future consideration the 5150-5250 MHz band as a potential destination band for DOD aeronautical mobile telemetry systems, allowing greater flexibility in FCC decisions with respect to improving access to the 5 GHz band for unlicensed broadband devices.⁹²

Reevaluation and Reprioritization of Selected Bands

During this reporting period, NTIA, in coordination with the PPSG, continued to reevaluate and prioritize the frequency bands previously identified for more detailed evaluation and potential repurposing. As a result of this reevaluation and the progress made in transitioning previously prioritized bands, NTIA modified the list of bands still under consideration for potential repurposing to exclusive non-federal use or shared federal/non-federal use.

Table 2-3 below shows the band selection factors and their brief descriptors, which NTIA and the PPSG used to reevaluate the bands. Table 2-4 below provides the reprioritization results according to the categories and factors presented in Table 2-3, with adjustments to reflect the progress outlined above and further sharing studies. However, based on the results of the spectrum use quantification assessments, NTIA and the SPT will reconsider the prioritization of these bands.

⁹⁰ *Tax Relief Act* § 6406, 47 U.S.C. § 1453.

⁹¹ *See 5 GHz NPRM*, 28 FCC Rcd at 1781 n.45.

⁹² *See NTIA July 2013 Letter* at Enclosure 1. *See also NTIA April 2013 Letter* at 3; Letter from Lawrence E. Strickling, Assistant Secretary for Communications and Information, U.S. Dept. of Commerce, to Julius Genachowski, Chairman, FCC, in ET Docket No. 13-49 (Feb. 19, 2013) at 3-4, *available at* <http://apps.fcc.gov/ecfs/document/view?id=7022126657>; FCC, Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band, *Notice of Proposed Rulemaking* in ET Docket No. 13-49, 28 FCC Rcd 1769, 1781 n.45 (2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-13-22A1_Rcd.pdf.

Table 2-3 Band-Selection Factors		
Non-federal exclusive use	Non-federal/federal shared use (licensed wireless services)	Non-federal/federal shared use (unlicensed wireless devices)
<ul style="list-style-type: none"> • Available bandwidth • Estimated revenue potential • Technology • Comparable spectrum • Relocation costs • Achievable within ten years • Level of difficulty of required international agreements* 	<ul style="list-style-type: none"> • Shared bandwidth • Geographical coverage • Estimated revenue potential • Technological complexity • Achievable within ten years • Level of difficulty of required international agreements* • Sharing cost 	<ul style="list-style-type: none"> • Shared bandwidth • Geographical coverage • Achievable within ten years • Level of difficulty of required international agreements*

* Bands obligated by U.S.-Canada or U.S.-Mexico bilateral agreement(s) will require international consideration if repurposed.

Table 2-4 Reprioritization Results for Repurposing Federal and Shared Spectrum Bands		
Licensed non-federal exclusive use bands	Non-federal/federal shared use bands	Federal sharing w/ unlicensed devices
<ol style="list-style-type: none"> 1. 2700-2900 MHz 2. 406.1-420 MHz 3. 1370-1390 MHz 4. 4200-4400 MHz 	<ol style="list-style-type: none"> 1. 1300-1370 MHz 2. 1675-1695 MHz 3. 2700-2900 MHz 4. 2900-3100 MHz 5. 3100-3550 MHz 6. 1780-1850 MHz 	<ol style="list-style-type: none"> 1. 5350-5470 MHz 2. 5850-5925 MHz

First, NTIA removed the 1755-1780 MHz portion of the 1755-1850 MHz band from the list in Table 2-4 because agencies are in the transition planning phase for this band segment pursuant to the *Ten-Year Plan*.⁹³ The 1780-1850 MHz band was moved to the “shared use” column in light of the recommendations of the CSMAC, the proposed industry roadmap, and the DOD proposal discussed above with regard to the difficulties of clearing the entire 1755-1850 MHz band and the need to compress certain systems in the upper part of the band. Due to the relocation of systems from 1755-1780 MHz, the 1780-1850 MHz band will see significant change over the next few years. Therefore, for that band, applicable agencies will include in their regular five- and ten-year assignment reviews quantitative assessments of their spectrum usage.⁹⁴

⁹³ See *Ten-Year Plan* at 14-15. In the *Third Interim Report*, NTIA removed 1695-1710 MHz and 3550-3650 MHz bands from the list because they were similarly in the transition planning phase based on NTIA’s recommendation that the FCC take necessary regulatory actions to repurpose them. See *Third Interim Report* at 13.

⁹⁴ See *supra* note 64.

Second, based on the results of a National Aeronautics and Space Administration (NASA) study, the PPSG agreed to remove the 2200-2290 MHz band from the previous list. The study assessed potential interference from terrestrial base station and user equipment transmitters operating in the 2200-2290 MHz band to a geostationary Tracking and Data Relay Satellite System (TDRSS) satellite receiving data from the International Space Station (representative of an object in low Earth orbit). The study concluded that high-density terrestrial mobile operations would cause significant interference to TDRSS satellite receivers.⁹⁵

The international allocation to the mobile service in the 2200-2290 MHz band prohibits “high-density mobile systems.”⁹⁶ In ongoing ITU studies of candidate bands for mobile broadband in preparation for WRC-15, the member states expressed broad opposition to mobile broadband in this frequency band.⁹⁷ In light of the “technological complexity” and “achievable within ten years” band selection factors for shared use, this information strongly supports the PPSG’s decision to remove this band from consideration.

Third, NTIA added back 50 megahertz of spectrum in the middle column onto the end of the 3100-3500 MHz band. Pursuant to the *Ten-Year Plan*, NTIA had prioritized the 3500-3650 MHz band for detailed evaluation for potential repurposing.⁹⁸ In the *Fast Track Report*, NTIA recommended reallocating 100 megahertz of the 3500-3650 MHz band (3550-3650 MHz) for wireless broadband use within five years.⁹⁹ Subsequently, NTIA added the 3100-3500 MHz band to the list of prioritized blocks of spectrum to consider and evaluate for repurposing for shared non-federal/federal use.¹⁰⁰ When NTIA removed 3550-3650 MHz from the list in Table

⁹⁵ See ITU, Radiocommunication Sector, U.S. contribution to Joint Task Group 4-5-6-7, *Proposed Updates to Preliminary Draft New Report ITU-R SA. [2 025-2 290 MHz]*, Document 4-5-6-7/337, (Oct. 14, 2013) at 27-28, available at <http://www.itu.int/md/R12-JTG4567-C-0337/en>.

⁹⁶ See ITU, *Radio Regulations*, Vol I—Articles (Edition of 2012), at RR5-75 (Footnote 5.391) and -76, available at <http://www.itu.int/pub/R-REG-RR/en>.

⁹⁷ See ITU, Radiocommunication Sector, Annex 9 to Joint Task Group 4-5-6-7 Chairman’s Report, *Summary of Comments Received in Joint Task Group 4-5-6-7 Input Contributions Relating to Certain Frequency Bands Which May Be Considered Under WRC-15 Agenda Item 1.1*, Annex 9 to Document 4-5-6-7/393, (Nov. 4, 2013) at 27-28, available at <http://www.itu.int/md/R12-JTG4567-C-0393/en> (*ITU Candidate Bands*), which, in support of possible additional mobile service allocations for mobile broadband at WRC-15, lists documents contributed to the ITU on this topic that provide studies or express views on the “appropriateness or inappropriateness” of frequency bands for mobile broadband. Based on quotations from contributions, administrations broadly oppose consideration of the 2200-2290 MHz band for mobile broadband, though some support studies of the issue.

⁹⁸ See *Ten-Year Plan* at 10-11; See NTIA, *First Interim Progress Report on the Ten-Year Plan and Timetable* (Apr. 4, 2011) at 4, available at http://www.ntia.doc.gov/files/ntia/publications/first_interim_progress_report_04012011.pdf.

⁹⁹ See *Fast Track Report* at v.

¹⁰⁰ See NTIA, *Second Interim Progress Report on the Ten-Year Plan and Timetable* (Oct. 17, 2011) at 8, Table 2-3, available at http://www.ntia.doc.gov/files/ntia/publications/second_interim_progress_report_on_the_ten_year_plan_and_timetable.pdf.

2-3 in the last interim report, it also removed the 3500-3550 MHz segment that NTIA had studied during the fast track analysis.¹⁰¹ However, NTIA had based that analysis on its interest in seeking spectrum that it could repurpose predominantly for consumer uses in less than five years. Like the spectrum below it, 3100-3500 MHz, the 3500-3550 MHz band should be considered for sharing. Accordingly, as reflected in Appendix A, 3100-3550 MHz will be subject to the quantitative assessment.

During the forthcoming year, the other bands listed in Table 2-3 will be subject to further evaluation and assessment. Specifically, the National Oceanic and Atmospheric Administration (NOAA) is exploring the feasibility of relocating radiosondes operations from the 1675-1680 MHz band to the 400 MHz band in order to accommodate terrestrial broadband transmitters. NOAA is also studying the potential impacts of such transmitters into weather satellite earth stations in the adjacent 1680-1695 MHz band.¹⁰² As reflected in Appendix A, 1675-1695 MHz will be subject to the quantitative assessment to support the ongoing evaluation of sharing approaches for this and adjacent spectrum bands.

In addition, the 4200-4220 MHz and 4380-4400 MHz bands appear to be less likely candidates for sharing with mobile broadband. As reported previously, the Federal Aviation Administration (FAA) performed some testing to demonstrate the potential impact of wireless broadband use on a shared basis with pulse radio altimeters. However, the level of performance degradation was difficult to ascertain.¹⁰³ International Telecommunication Union (ITU) member states and international aviation organizations opposed U.S. efforts toward international study of these bands.¹⁰⁴ Moreover, parallel international efforts are underway to introduce wireless sensors in these bands on aircraft as part of the Wireless Avionics Intra-Communications (WAIC) system.¹⁰⁵ Therefore, NTIA will ask the PPSG to reevaluate these bands for

¹⁰¹ See *Third Interim Report* at 13, Table 2-3.

¹⁰² The Administration's proposed Fiscal Year 2014 budget proposes to direct the FCC to repurpose 1675-1680 MHz for wireless broadband use by 2017, subject to sharing arrangements with Federal weather satellites. See FCC, *Fiscal Year 2014 Budget Estimates Submitted to Congress* at 5 (Apr. 2013), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-320096A1.pdf.

¹⁰³ See *Third Interim Report* at 10.

¹⁰⁴ See, e.g., ITU, Radiocommunication Sector, International Civil Aviation Organization (ICAO) contribution to ITU-R Working Party 5B, *ICAO Position for the WRC-15*, Document 5B/337, (Oct. 7, 2013) at 10, available at <http://www.itu.int/md/R12-WP5B-C-0337/en> (stating ICAO's WRC-15 position in opposition to any new allocation to the mobile service in frequency bands allocated to aeronautical safety services, such as the aeronautical radionavigation service, to which the 4200-4400 MHz band is allocated, "[u]nless it has been demonstrated through agreed studies that there will be no impact on aeronautical services." See also *ITU Candidate Bands* at 40. None of the other contributions address the 4200-4400 MHz band.

¹⁰⁵ See ITU, Radiocommunication Sector, U.S. contribution to ITU-R Working Party 5B, *Update to Working Document Towards Draft CPM Text for Agenda Item 1.17 (WAIC)*, Document 5B/410, (Nov. 12, 2013) at 4-5, available at <http://www.itu.int/md/R12-WP5B-C-0410/en>, where the United States proposes a frequency allocation in the 4200-4400 MHz band, limited to WAIC systems, as the sole "method" to satisfy the pertinent agenda item at

repurposing. The bands remain on the list in Table 2-3 but are not included in the plan for the quantitative assessment in Appendix A.

International Activities

Since early 2012, professional staff from NTIA, the FCC, the State Department, other federal agencies, and the telecommunications industry have been participating in domestic, regional, and international activities in preparation for WRC-15, which is scheduled to meet in November 2015 in Geneva, Switzerland. A key issue on the agenda for this conference will be “to consider additional spectrum allocations to the mobile service...to facilitate the development of terrestrial mobile broadband applications.”¹⁰⁶

In these preparations, NTIA works with the federal agencies to develop technical studies and proposed U.S. views in support of or in opposition to WRC-15 consideration of specific frequency bands for mobile broadband. Subsequently, NTIA and agency representatives work with industry and the FCC through the State Department to reach agreement on U.S. positions, as well as technical studies that support these positions.

With encouragement from the United States, the ITU’s Radiocommunication Sector established Joint Task Group (JTG) 4-5-6-7 in January 2012 to oversee international preparations on this issue, bringing together representatives of four of its study groups.¹⁰⁷ The JTG is considering satellite, terrestrial, broadcasting, and science service interests in identifying appropriate bands for mobile broadband, based on contributions from member states and other ITU-R members.

NTIA and the other U.S. interests are also participating in two working groups of ITU-R Study Group 5, Working Party 5A (land mobile service) and Working Party 5D (IMT systems), which have been given roles in determining spectrum requirements and suitable frequency ranges for mobile broadband and International Mobile Telecommunications (IMT) systems. During this period, NTIA prepared for and participated in the second and third meetings of the JTG in November 2012 and July 2013. At these meetings, the JTG progressed sharing and compatibility studies on candidate frequency bands, and began developing a report to provide background material and possible “methods” for WRC-15 to decide on additional mobile service

WRC-15.

¹⁰⁶ See ITU, Radiocommunication Sector, *Results of the first session of the Conference Preparatory Meeting for WRC-15 (CPM15-1)*, Administrative Circular CA/201, (Mar. 19, 2012) at Annex 1, *Agenda for the 2015 World Radiocommunication Conference*, ¶ 1.1, available at <http://www.itu.int/md/R00-CA-CIR-0201/en>.

¹⁰⁷ See *id.* at Annex 10, *CPM15-1 Decision on the Establishment and Terms of Reference of Joint Task Group 4-5-6-7*.

allocations.¹⁰⁸

During FY 2013, NTIA also participated in two meetings of Working Party 5A and three meetings of Working Party 5D, at which the groups completed their work in support of the JTG.¹⁰⁹

3. CONCLUSION

NTIA and the FCC, together with the federal agencies in the PPSG, are continuing to work diligently toward achieving the goals of the *2010 Presidential Memorandum* through ongoing rulemaking proceedings and implementation of the *Ten-Year Plan*, applicable provisions of the *Tax Relief Act*, and the *2013 Presidential Memorandum*. The focus for the next 12 months will be to engage industry and government stakeholders to ensure a smooth transition of the 1695-1710 MHz and 1755-1780 MHz bands as the FCC approaches the auction for these bands. NTIA, the FCC, and affected federal agencies will continue to work with industry stakeholders to enable broadband wireless access to the 3550-3650 MHz band, and the 5 GHz bands.

In addition, pursuant to the plan set forth in Appendix A, applicable agencies will be conducting quantitative assessments of their usage of spectrum in 960 megahertz of spectrum. Finally, NTIA, in cooperation with the FCC and the Department of State, will continue with preparations for WRC-15, seeking to expand opportunities for global access to spectrum for wireless broadband services and devices while studying new access methods based on sharing.

¹⁰⁸ The JTG also held a fourth meeting in October 2013 to continue this work. The JTG scheduled its fifth and sixth meetings in February and June 2014, respectively. At these meetings, the JTG plans to complete its sharing and compatibility studies, as well as its report for WRC-15, *see* ITU, Radiocommunication Sector, *Report on the Fourth Meeting of Joint Task Group 4-5-6-7*, Document 4-5-6-7/393 (Nov. 27, 2013) at Annex 1, *Work Plan on the Preparation of WRC-15 Agenda Items 1.1 and 1.2*, available at <http://www.itu.int/md/R12-JTG4567-C-0393/en>.

¹⁰⁹ *See* ITU, Radiocommunication Sector, *Working Party 5A (WP 5A) - Land mobile service above 30 MHz (excluding IMT), wireless access in the fixed service, amateur and amateur-satellite services*, available at <http://www.itu.int/ITU-R/index.asp?category=study-groups&mlink=rwp5a&lang=en>; ITU, Radiocommunication Sector, *Working Party 5D (WP 5D) - IMT Systems*, available at <http://www.itu.int/ITU-R/index.asp?category=study-groups&mlink=rwp5d&lang=en>.

APPENDIX A

PLAN FOR QUANTITATIVE ASSESSMENTS OF SPECTRUM USAGE

Introduction

Section 3(a) of the *2013 Presidential Memorandum* directs NTIA, in consultation with the SPT and appropriate agencies, to include in this *Fourth Interim Progress Report* a plan directing applicable agencies to provide quantitative assessments of the actual usage of spectrum in those spectrum bands that NTIA previously identified and prioritized in its *Third Interim Report* and such other bands as NTIA and the SPT determine have the greatest potential to be shared with non-federal users. As specified in the memorandum, each applicable agency shall prepare an assessment in accordance with such metrics and other parameters as are reasonably necessary to determine the extent to which spectrum assigned to the agency could potentially be made available for sharing with or release to commercial users, particularly in major metropolitan areas, without adversely affecting the agency's missions, especially those related to national security, law enforcement, and safety of life. The memorandum further requires that each agency assessment include a discussion of projected increases in spectrum usage and needs and identify where access to non-federal spectrum could aid in fulfilling agency missions. Pursuant to the memorandum, each applicable agency shall submit its assessment to NTIA and the SPT within 12 months of the release of this plan.

This plan calls for the quantitative assessment of 960 megahertz of spectrum from the five bands specified in Table A-1. To supplement the metrics and parameters already associated with their frequency assignments contained in the Government Master File (GMF), agencies shall submit additional data for each system's individual transmitting and receiving stations as necessary for developing an accurate approximation of the extent to which each system is actually using the spectrum. The data includes parameters for time, spectrum (frequency and bandwidth), and geographic area that can be used to project the coverage area and time of use for each operation and to determine sharing potential. The plan provides guidance for assessing the variety of fixed, mobile, and transportable transmitting stations, the different types of geographic assignments, and receive-only stations. It identifies the data elements for each station that applicable agencies must submit, review, and verify.

NTIA will assist the applicable agencies throughout their assessments and compile and summarize the data from their quantitative assessments. While the agency assessments will not be based on measured data of actual day-to-day operations, agency assignment data regarding time of use will be significantly improved to more accurately determine expected usage in particular geographic locations. NTIA and the SPT will use the compilation of the data resulting

from the quantitative assessments to identify the bands to be considered for more detailed sharing feasibility studies, and potentially for government/industry collaborative efforts.¹

This plan also seeks information from the applicable agencies on their projected increases in spectrum usage as well as detailed information regarding any non-federal bands in which agency operations could be performed to aid in fulfilling their missions. Finally, the plan sets forth the target dates and deliverables for the agency assessments.

Frequency Bands for Quantitative Assessments

NTIA has identified the frequency bands in Table A-1 to be subject to the quantitative assessments. NTIA will provide matrices of assignment data for the bands identified in Table A-1 to each applicable agency, including allocations and frequency assignments (by agency and application) for all systems operating in the band and that are planned to operate in the band (*i.e.*, certification information for systems going through that process). Each agency will then validate its assignment information.

Table A-1. Federal and Shared Spectrum Bands for Quantitative Assessment			
Frequency Band (MHz)	Amount (megahertz)	Current Allocation/Usage (federal, non-federal, shared)	Federal Agencies with Assignments in the Frequency Band²
1300-1390	90	federal	AF, AR, DHS, FAA, MC, N, NASA
1675-1695	20	federal/non-federal shared	AF, AR, DOC, DOE, MC, N, NASA
2700-2900	200	federal	AF, AR, DOC, DOE, FAA, MC, N, NASA, NSF
2900-3100	200	federal/non-federal shared	AF, AR, CG, DHS, DOC, DOE, EPA, FAA, N, NASA, DOT
3100-3550 ³	450	federal/non-federal shared	AF, AR, N
	290	Sub-total, federal	
	670	Sub-total, federal/non-federal shared	
	960	Total	

¹ NTIA would conduct a more detailed evaluation based on technical, operational, and cost considerations to ascertain whether or not particular bands can be repurposed. *See Ten-Year Plan* at 12-13.

² The table of acronyms and abbreviations in Appendix B includes these agency abbreviations.

³ NTIA assessed the 3500-3550 MHz band with the 3550-3650 MHz band in the *Fast Track Report*, determining that the 50 megahertz is necessary to ensure adjacent channel protection of federal systems. NTIA based its recommendation to reallocate the 3550-3650 MHz band for geographic sharing on establishing this 50 megahertz guardband.

NTIA included the 1780-1850 MHz band in its prioritization in *Third Interim Report*, but due to the reallocation of the 1755-1780 MHz band, systems and frequency assignments will be changing for a period of time, making an accurate representation of usage in this band impossible in the short term. After the transition is completed, quantitative information on the use of spectrum for this band will be provided as agencies conduct regular five- and ten-year assignment reviews and for new assignments, based on methodologies that will be developed, agreed upon, and included as part of the NTIA assignment review process going forward.

Metrics and Parameters for Quantitative Assessments

Many of the metrics and parameters that are necessary to determine the extent to which spectrum assigned to or used by the agencies from the five bands under review are already contained in the GMF, which is updated on a weekly basis.⁴ The GMF contains records of all NTIA authorized federal frequency assignments in the bands identified above for the quantification assessments. The assignments contained in the GMF will be used by federal agencies as the basis for their quantitative assessments in accordance with the particulars of those assignments.⁵ All federal agencies must maintain a program of continuing review of its assignments and shall delete or amend such assignments as appropriate.⁶

Generally, the number and type of frequency assignments in the frequency bands under review provide a measure of only the potential usage in that band by applicable federal agencies, but this number and the distribution of assignments among these specific agencies do not necessarily serve as an accurate reflection of their actual usage. An individual frequency assignment in the bands under review may also represent a single system or multiple systems. Each assignment might be for a single location or link with a transmit and a receive location, for a specified radius of authorized operation, or for use across large areas such as statewide, regional, in the conterminous United States, or the entire United States and Possessions.⁷

The current GMF data for the bands under review do not include all of the information and data necessary for the accurate quantification of spectrum use by the applicable agencies. For example, depending on the frequency band, some frequency assignment records in the GMF do not include information regarding the amount of time the systems operate. Specifically, the “Time” (TME) data field in the GMF frequency assignment records describes the time during which it is intended that the frequency will be either guarded (monitored) or used for

⁴ See NTIA Manual at Section 8.1.1. While not available to the public, the GMF is available to the FCC and other federal agencies.

⁵ *Id.* at Section 7.2.

⁶ *Id.* at Section 8.2.6.

⁷ *Id.* at Section 7.3.3 and Section 9.8.2 ¶¶ 21, 30, and 39.

transmission.⁸ Nor does the GMF include receive stations that operate in the 1675-1695 MHz band because NTIA does not require frequency assignments for them. Accordingly, NTIA’s GMF records of each agency’s authorizations, supplemented by information on the receive stations, will serve as the foundation or starting point for each quantification assessment.

NTIA will provide the available data for agency review and verification. Each applicable agency must review, update, and supplement the information, including the relevant data fields that indicate the normal period of time during which the agency uses the frequency to satisfy its operational requirements.⁹ NTIA will work with each agency to develop a feasible approach to accurately reflect the time of use parameter based on the nature of each system and its mission requirements. For example, each agency could provide GMF TME data based on the annual, weekly, and daily values set forth in the *NTIA Manual* or as proxies for the daily use percentages listed in Table A-2. While resource-intensive monitoring or logging of actual transmissions will not be necessary based on the primary purpose of these assessments, the time of use parameter should represent, at a minimum, the agency’s best approximation of the percentage of time of actual use, and not the expected time period (or percentage) access might be required or system tests are occurring.¹⁰ Each agency should include a description of how it addresses time of use variations.

Table A-2. Guidance on Time of Use		
TME Field Entry	Description of Actual Use	Percentage of Time Frequency is Used per Day
1	Constant or nearly	50 to 100
2	Regular/frequent	10 to 50
3	Intermittent	1 to 10
4	Sporadic/occasional	Less than 1

Tables A-3 and A-4 below summarize the additional parameters and data elements for the transmitting and receiving stations necessary for this plan in the bands subject to quantitative assessment. Each agency needs to ensure that these parameters and elements are accurately reflected. Each agency shall review, verify, update, or supplement the data elements contained in Table A-3 for transmitting stations operating in the bands under review. Each applicable

⁸ *Id.* at Section 9.8.2 ¶ 19, describing the four character TME-Time field. 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 agency’s operational requirements.

⁹ Each GMF frequency assignment record provides for a four character TME-Time field, but this field is currently not required for the frequency bands subject to this quantitative assessment.

¹⁰ Time of use may be quantified for periods of active transmissions or, for receive-only systems such as passive sensors, for the periods of actual reception or operation. Each agency should base this usage information on actual access and availability needs critical to mission or operational requirements.

agency needs to ensure that these fields are accurately represented. Each applicable agency shall provide the data elements contained in Table A-4 for receiving stations operating in the bands under review.

Table A-3. Transmitter Data Elements	
Parameter	Units
Frequency	Megahertz
Latitude and longitude	Degrees/Minutes/Seconds
Transmitter necessary bandwidth	Hertz
Transmitter power	Watts
Transmit mainbeam antenna gain	Decibels referenced to an isotropic antenna
Transmit antenna height	Meters
Area of operation (for mobile and transportable systems): Radius of operation defining area of operation Latitudes and longitudes defining area of operation Authorized state(s)/nationwide defining area of operation	Kilometers Degrees/Minutes/Seconds Annex G ¹¹
Pulse width (for pulsed systems)	Microseconds
Pulse repetition interval (for pulsed systems)	Microseconds

Table A-4. Receiver Data Elements	
Parameter	Units
Frequency	Megahertz
Latitude and longitude	Degrees/Minutes/Seconds
Intermediate frequency receiver 3 dB bandwidth	Hertz
Receive mainbeam antenna gain	Decibel referenced to an isotropic antenna
Receive antenna gain pattern	Decibel referenced to an isotropic antenna as a function of off-axis angle in degrees
Receive antenna height	Meters
Receive antenna azimuth angle	Degrees
Receive antenna minimum elevation angle	Degrees

Based on each agency's assessment of the most up-to-date and accurate parameters and data elements as set forth above, the key metric that NTIA will derive from such data will be the cumulative *Total Spectrum Usage*. For the purpose of the quantitative assessments directed by this plan, *Total Spectrum Usage* would represent the percentage of time the authorized systems within a geographic area transmit or receive on a frequency and bandwidth. Specifically, in order to derive this metric, NTIA will use the verified information provided by each agency to

¹¹ See *NTIA Manual* at Annex G, which contains abbreviations used for the transmitter and receiver state fields in the GMF.

first project the actual bandwidth utilized and area of coverage for each operation. The bandwidth and coverage area will reflect the geographic coverage of each system, and will also indicate the frequencies and the area in which the agency's system is operational.

For each fixed transmitting station in the bands under review, the necessary spectrum and geographic parameters to be verified and assessed include the station's latitude and longitude, center frequency, necessary bandwidth, power, antenna gain, and antenna height for each frequency assignment. For pulsed signals at a fixed station, each agency must review and verify the pulse width and pulse repetition interval. Each applicable agency must review and verify the authorized area of operation for each mobile and transportable station assignment, which may include the radius of operation around a specific point (latitude and longitude) or other specific coordinates (*e.g.*, northeast and southwest corners of a rectangular area).

As part of the assessment, NTIA will work with each agency to develop a feasible approach to accurately reflect its actual area of operations. For example, each agency would consider whether the authorized area of operation for a frequency assignment accurately reflects the area covered by mobile and transportable stations or the approximate extent of expected usage that actually occurs in the covered area. Some frequency assignments in the bands under review authorize operation on a nationwide or statewide basis. In reviewing its nationwide and statewide frequency assignments, each applicable agency would, to the extent practicable, specify locations or areas within which its operations actually occur. This could include a breakdown of operational activities by county or other area (*e.g.*, within a radius surrounding a particular point) associated with the time of use parameter discussed above at each specific location.

For receive-only stations for which there is no data or incomplete data in the GMF, each applicable agency that operates such a station in the bands under review must submit the information listed in Table A-4 by creating a new record in the GMF using the Frequency Assignment Subcommittee (FAS) frequency application procedures. The GMF does not include data fields for many of the receiver parameters needed for the quantitative assessment. If a GMF data field does not exist, each applicable agency would insert the receiver data parameter in the CIRCUIT REMARKS field of the new assignment record. This information is intended to account for the receivers currently operating in these bands as a result of each agency's data validation process.

Percentage of Population Calculation

NTIA will calculate the estimated percentage of use per population based on the methodology described below and provide its draft compilation and summary of the agency quantitative assessments to the agencies and SPT for review. To determine quantitative use based on the data compiled from the applicable agencies, NTIA will use the validated GMF data and other information to determine bandwidth and geographic area around the various frequency

assignments. NTIA will perform calculations to estimate the total percentage of population affected by all of the federal frequency assignments in a given area based on the 2010 U.S. Census data available from the Census Bureau's Gazetteer web page at <http://www.census.gov/geo/maps-data/data/gazetteer2010.html>.

NTIA will calculate the estimated population percentage for a given area by taking the center coordinates for the locations of each of the federal frequency assignments and determining the places that fall within the overlapping geographic areas, computed using the compiled GMF data. The total percentage of population affected will be the summation of the population of the individual locations that fall within the geographic area divided by the entire population for a given area.

Additional Agency Considerations that Impact Quantitative Assessment of Spectrum Use

While the quantitative assessments can assist in representing the use of the spectrum, the nature of the federal operations and mission requirements may directly impact the risks associated with sharing considerations. For example, while some federal systems may operate intermittently, these systems may support critical national security applications, which require high spectrum availability. The missions of many federal agencies require that spectrum be available when an incident or operation occurs. Each applicable agency should note that when it provides the time of use information, it should include any additional mission-related factors that NTIA and the SPT should consider, such as indication of safety of life related operations.

Protection of Classified Data

As specified in the *2013 Presidential Memorandum*, NTIA will release a public summary of the quantitative assessments. Consistent with the applicable regulations, NTIA will work with each applicable federal agency to ensure that any release of data protects classified, sensitive, and proprietary data.

Agency Projections for Future Spectrum Usage

Each agency with current operations in the bands under review, along with any agency expecting to deploy, change, or cease operations in the bands over the next ten years, must report on this projected usage, termination, and future developments. Each applicable agency should provide information regarding planned new uses, expected expansion of current uses, and potential relocation or cessation of use, projecting where and when these future uses or changes would increase or decrease its spectrum usage in the bands under review.

Access to Non-Federal Spectrum

Each agency conducting the assessment required under the *2013 Presidential Memorandum* shall identify where access to non-federal spectrum could aid in fulfilling its mission. Each applicable agency must submit any relevant information regarding its potential use of non-federal bands, including, but not limited to, the frequency band(s), a detailed

description of the operations that would be conducted in such band(s), the geographic area(s) over which such operations will be performed, and the estimated percentage of time the band(s) would be used.

Schedule and Deliverables for Agency Assessments

This plan requires each agency to review, verify, and update the relevant GMF data in order for NTIA to compile the final quantitative assessments of the bands under review and submit the results to the SPT by May 29, 2015. Table A-5 below provides the target dates and deliverables associated with this plan.

Table A-5 Target Dates and Deliverables	
Target Date	Deliverable
June 5, 2014	NTIA publishes this plan as part of <i>Fourth Interim Progress Report</i> .
July 7, 2014	NTIA's Office of Spectrum Management (OSM) provides each applicable agency additional detailed instructions, including guidance on the methodology to be used in performing the quantitative assessment, along with a list of frequency assignments in the bands identified in this plan.
August 8, 2014	Each agency reviews and verifies that each frequency assignment listed by OSM is subject to this quantitative assessment as described above.
January 5, 2015	After verification, each agency updates the information for any assignments omitted from the list, and for any station, system, or facility using or authorized to use the bands identified in this plan that is not included in the GMF data or does not otherwise require an assignment from NTIA (<i>i.e.</i> , receivers) consistent with the data elements included in Tables A-3 and A-4 to this Appendix. For each assignment, the agency will provide the estimated percentage of time using the guidance provided in Table A-2. The agency may provide any additional mission-related factors NTIA should consider.
May 5, 2015	NTIA calculates the estimated percentage of use per population and provides its draft compilation and summary of the quantitative assessments to the applicable agencies for review.
June 5, 2015	Each applicable agency reviews NTIA's compilation/summary and submits its final quantitative assessment to NTIA and the SPT consistent with this plan and any further instructions and guidance.

APPENDIX B

ACRONYMS AND ABBREVIATIONS

AF	Air Force
AR	Army
AWS	Advanced Wireless Services
CG	Coast Guard
CSEA	Commercial Spectrum Enhancement Act
CSMAC	Commerce Spectrum Management Advisory Committee
DHS	Department of Homeland Security
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DSRC	Dedicated Short-Range Communications
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FAS	Frequency Assignment Subcommittee
GHz	gigahertz
GMF	Government Master File
IEEE	Institute of Electrical and Electronics Engineers
ICAO	International Civil Aviation Organization
IMT	International Mobile Telecommunications
ITAC	International Telecommunication Advisory Committee
ITU	International Telecommunication Union
JTG	Joint Task Group
JTRS	Joint Tactical Radio System
LTE	Long Term Evolution
MC	Marine Corps
MHz	megahertz
N	Navy

NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NPRM	Notice of Proposed Rulemaking
NSF	National Science Foundation
NTIA	National Telecommunications and Information Administration
OMB	Office of Management and Budget
OSM	Office of Spectrum Management
PCAST	President's Council of Advisors on Science and Technology
PPSG	Policy and Plans Steering Group
RLAN	Radio Local Area Network
SAR	synthetic aperture radar
SPT	Spectrum Policy Team
TME	TIME
TDRSS	Tracking and Data Relay Satellite System
TRR	tactical radio relay
U-NII	Unlicensed-National Information Infrastructure
WAIC	Wireless Avionics Intra-Communications
WCS	Wireless Communications Service
WISP	Wireless Internet Service Provider
WTB	Wireless Telecommunications Bureau
WRC-15	2015 World Radiocommunication Conference