

UNITED STATES OF AMERICA
PROPOSAL FOR THE WORK OF THE CONFERENCE

Agenda Item 1.1: *to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution 233 (WRC-12)*

Background Information: The 3 400-3 700 GHz (extended C-band) and 3 700-4 200 GHz (C-band) frequency ranges have been used by the Fixed Satellite Service (FSS) receiving earth stations for the past 50 years. The 3 700-4 200 GHz band, in particular, is the mainstay spectrum for the FSS operations. There are approximately 180 geostationary satellites operating in these bands, and many new satellites with C-band capacity have been constructed or are under construction and scheduled to be launched in the near future. The C-band, with its unique and important technical properties, such as low rain fade and coverage of wide service areas, is extensively used worldwide. After many decades of development, C-band payloads reflect an efficient, proven technology; this allows for very low cost equipment which benefits users, small and large, in developing and developed nations. This is also the reason why many countries have utilized the C-band to establish themselves as space-faring nations, placing their important national telecommunication and broadcasting infrastructure in the bands with high availability and reliability, at the lowest costs. C-band satellite links play a key role in the distribution of video signals to cable head-ends as well as backhaul for cellular terrestrial networks. In addition, many highly sensitive and public services are also using FSS C-band, such as satellite telemetry, disaster relief, public meteorological data distribution, and aeronautical applications in various regions. Similar to other Region 2 countries, in the United States, there are no FSS operations in the 3 400-3 600 MHz band, limited FSS deployments in the 3 600-3 700 MHz band and extensive FSS operations in the 3 700-4 200 MHz band. Recognizing these facts, the United States is committed to preserving the availability of the 3 700-4 200 MHz band for future FSS operations.

From the terrestrial mobile broadband (IMT) perspective, the 3 400-4 200 GHz frequency range is particularly attractive as it offers the potential for large, contiguous bandwidths within a single band. This frequency range is suitable for accommodating IMT, in particular IMT-Advanced, systems utilizing wider channel bandwidths, thereby, providing greater capacity. As antenna size is proportional to wavelength, it is easier to accommodate multiple antennas in a handset in these frequency bands relative to lower frequency bands. The 3 400-4 200 MHz frequency range is also attractive due to the ability to implement multiple-input/multiple-output (MIMO) antennas, which enable higher spectral efficiency (capacity) and higher throughput (data rates). Another significant advantage of the C-band for IMT is the availability of the standardized commercially available equipment which allows domestic operators to deploy in portions of the C-band range as they are made available. Many administrations have assigned or plan to assign mobile broadband licenses within the 3 400-3 800 MHz frequency range using unpaired

frequency blocks.¹ Networks operating in unpaired frequency blocks utilize Time Division Duplexing (TDD) in which downlink and uplink transmissions are carried over the same frequency but at different times. The lack of a defined duplex gap separating uplink and downlink provides the flexibility to operate in any portion of the band within the frequency range. TDD networks can be especially beneficial in cases of asymmetric traffic as assignment of transmission capability could be varied, for instance to support more downlink traffic.

In Region 2, the entire 3 400-4 200 GHz frequency range is allocated to FSS (space-to-Earth) and Fixed Service on the primary basis. There is also a primary allocation to the Mobile Service the bands 3 500-3 700 MHz and 3 700-4 200 MHz and in the band 3 400-3 500 MHz via footnote **5.431A** in fourteen Region 2 countries.

Recognizing the importance of the C band frequency range to the existing operations (e.g., FSS) and the need for additional globally/regionally harmonized mobile broadband spectrum, the proposal, presented herein, concerning IMT harmonization in the C-band is premised on two principles:

- *International (i.e., cross-border) interference protection for incumbent service*

Protection of the incumbent services is a priority for all ITU member states. In case of terrestrial systems such as IMT, the objective is to protect existing services from cross-border interference. In this regard, first, it is important to note that the C-band's limited propagation characteristics make it well-suited for international (i.e., cross-border) spectrum sharing. All other things being equal, under the free space line of sight condition, a signal propagating at 3.5 GHz would be expected to decay faster than a signal in lower frequency bands that are currently used for mobile/IMT.² The limited signal propagation in the C-band minimizes the risk of harmful interference to geographically separated (i.e., cross-border) users. Thus, there is a relatively minimal interference threat to the incumbent systems (e.g., FSS receivers) in the cross-border scenario, while deployment of mobile/IMT systems within a country is exclusively at the discretion of the national regulator and, therefore, not an issue for the World Radio Conference. To further minimize the potential for cross-border interference, the United States proposes a power flux-density (pfd) limit and No. **9.21**, which is consistent with existing regulatory provisions. It is also important to emphasize that IMT identification does not establish regulatory priority or obligate administrations, in any way, to curtail existing operations. In fact, consistent with provisions of the Radio Regulations concerning coordination in frequency bands allocated with equal rights to space and terrestrial services (see Nos. **9.17** and **9.18**), existing FSS earth stations would have coordination priority over newly deployed IMT systems.

¹ For example, TDD is the preferred channel arrangement for the 3 400-3 600 MHz and 3 600-3 800 MHz bands within CEPT. See ECC Decision (ECC/DEC/ (11)06) "Harmonised frequency arrangements for mobile/fixed communications networks (MFCN) operating in the bands 3 400-3 600 MHz and 3 600-3 800 MHz."

² A signal at 3.5 GHz yields a 29 percent reduced range compared to a signal at 2.5 GHz, 45 percent compared to 1.9 GHz, and 75 percent compared to at 850 MHz. These range limitations would be even greater in attenuated environments, where higher frequency signals are less prone to penetrate building materials.

- *International spectrum harmonization to enable introduction of mobile broadband services (i.e., identification for IMT):*

Spectrum harmonization facilitates global roaming, economies of scale and commonality of equipment, which is imperative given that mobile devices can be designed to operate only in a few frequency bands. Given the extensive FSS operations in the 3700–4200 MHz the United States does not seek an IMT identification for this portion of the band. The United States notes, however, that 90 countries have already identified 3 400-3 600 MHz for IMT in the Radio Regulations (via footnotes **5.430A**, **5.432A**, **5.432B** and **5.433A**) and more countries have indicated their intention to provide a similar identification at WRC-15. Many administrations, including some of the world's largest markets, have assigned spectrum licenses within the 3.5 GHz frequency range on an unpaired basis. Others have identified spectrum in this range for IMT and are in the process of assigning licenses. Consequently, standards have been developed for the entire 3 400-3 800 MHz frequency range and devices that can operate in unpaired blocks in any portion of this frequency range are already in production. As there is no need for a fixed duplex gap, this offers significant potential for economies of scale. Availability of the Time Division Duplexing standardized equipment allows countries in Region 2 and elsewhere to deploy mobile/IMT in different band segments (e.g., 3 400-3 500 MHz, 3 500-3 600 MHz, 3 600-3 700 MHz) consistent with their domestic priorities. In other words, with the IMT identification in 3 400-3 700 MHz and commercially available equipment, administrations in Region 2 have the flexibility to take full advantage of the international harmonization without deploying across the entire band and, as a result, would be able to preserve the continuity of their FSS and other operations. The United States, for example, is considering mobile broadband deployment in the band 3 550-3 700 MHz while other Region 2 countries are considering deployments in 3 400-3 600 MHz or 3 500-3 700 MHz. The United States does not intend to deploy mobile broadband systems in either the 3 400-3 550 MHz or 3 700-4 200 MHz bands.

Proposal:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

USA/1.1/1

2 700-4 800 MHz

Allocation to services		
Region 1	Region 2	Region 3
* * * * *		
3 400-3 600 FIXED FIXED-SATELLITE (space-to-Earth) Mobile 5.430A Radiolocation	3 400-3 500 FIXED FIXED-SATELLITE (space-to-Earth) <u>MOBILE except aeronautical mobile MOD 5.431A</u> Amateur <u>Mobile 5.431A</u> Radiolocation 5.433 5.282	3 400-3 500 FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile 5.432B Radiolocation 5.433 5.282 5.432 5.432A
	3 500-3 600 3 600-3 700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile <u>ADD 5.IMT-1</u> Radiolocation 5.433	3 500-3 600 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.433A Radiolocation 5.433
3 600-4200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile	3-500 3 600-3 700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile <u>ADD 5.IMT-2</u> Radiolocation	3 600-3 700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.435
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Reasons: The modifications are proposed to provide an identification for IMT in Region 2 in the frequency range 3 400 to 3 700 MHz in order to facilitate international spectrum harmonization. Harmonized worldwide bands for IMT enable global roaming and the benefits of economies of scale. Given that over 90 countries have already identified 3 400-3 600 MHz for

IMT at WRC-07, an identification to IMT in the 3 400-3 700 MHz frequency range offers great opportunity for harmonization. Limited signal propagation in the C-band reduces the risk of harmful interference to geographically separated (i.e., cross-border) users. The interference threat to incumbent systems (e.g., FSS receivers) in the cross-border scenario is relatively small. Deployment of mobile/IMT systems within a country is exclusively at the discretion of the national authority and, therefore, not an international spectrum allocations issue. To further mitigate possible cross-border interference, existing coordination provisions are emphasized below. Also, in the United States, there are no FSS operations in the 3 400-3 600 MHz band, very limited FSS deployments in the 3 600-3 700 MHz band and extensive FSS operations in the 3 700-4 200 MHz band. No proposals are made concerning Regions 1 and 3. Allocations in Regions 1 and 3 are presented above only for information.

NOC

USA/1.1/2

2 700-4 800 MHz

Allocation to services		
Region 1	Region 2	Region 3
* * * * *	3 700- 4 200 FIXED FIXED-SATELLITE (space to-Earth) MOBILE except aeronautical mobile	* * * * *

Reasons: Due to extensive FSS deployments in the band 3 700-4 200 MHz in Region 2, this band is deemed not suitable for introduction of the mobile broadband applications such as IMT.

MOD USA/1.1/3

5.431A ~~*Different category of service: in Argentina, Brazil, Chile, Costa Rica, Cuba, French overseas departments and communities in Region 2, Dominican Republic, El Salvador, Guatemala, Mexico, Paraguay, Suriname, Uruguay and Venezuela*~~ In Region 2, use of the band 3 400-3 500 MHz by is allocated to the mobile, except aeronautical mobile, service on a primary basis, is subject to agreement obtained under No. 9.21, and the band, or portions of the band, is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Before an administration brings into use a base or mobile station of an IMT system in this band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed -154.5 dB(W/(m²·4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) with the assistance of the Bureau if so requested. In case of disagreement, the

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calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above.- Stations of the mobile service in the band 3 400-3 500 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of 2004). At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. (WRC-15~~2~~)

Reasons: Modification of this footnote is proposed in order to extend to the entire Region 2 the co-primary allocation to the mobile service while retaining the associated constraints on the mobile service. The modification also provides an identification for IMT. Continued application of No. **9.21** maintains regulatory priority for the existing services (e.g., FSS (space to-Earth)). Given that over 90 countries in Region 1 and 3 have already identified 3 400-3 600 MHz for IMT and more countries have indicated their intention to provide a similar identification at WRC-15, an identification to IMT in the 3 400-3 500 MHz frequency band in Region 2 offers great opportunity for global harmonization.

ADD USA/1.1/4

5.IMT-1 The band, or portions of the band, 3 500-3 600 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Before an administration brings into use a base or mobile station of an IMT system in this band, it shall seek agreement under No. **9.21** and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed -154.5 dB(W/(m²·4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. IMT stations in the band 3 500-3 600 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of 2004). At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply (WRC-15)

Reasons: Harmonized worldwide bands for IMT are highly desirable in order to achieve global roaming and the benefits of economies of scale. Given that over 90 countries have already identified 3 400-3 600 MHz for IMT and more countries have indicated their intention to provide a similar identification at WRC-15, a worldwide identification to IMT in the 3 500-3 600 MHz frequency bands offers great opportunity for harmonization. The United States, for example, is considering mobile broadband deployment in the band 3 550-3 700 MHz while other Region 2 countries are considering deployments in 3 400-3 600 MHz or 3 500-3 700 MHz. Application of the power flux-density limit and No. **9.21** provides for protection of the existing services. Additionally, Nos. **9.17** and **9.18** mandate coordination between terrestrial stations in the mobile

service (e.g., IMT) and FSS earth stations, thereby addressing the remote possibility of cross-border interference.

ADD USA/1.1/5

5.IMT-2 The band, or portions of the band, 3 600-3 700 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. Before an administration brings into use a base or mobile station of an IMT system in this band, it shall seek agreement under No. **9.21** and ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$ for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. IMT stations in the band 3 600-3 700 MHz shall not claim more protection from space stations than that provided in Table **21-4** of the Radio Regulations (Edition of 2004). At the stage of coordination the provisions of Nos. **9.17** and **9.18** also apply.

(WRC-15)

Reasons: Harmonized worldwide bands for IMT are highly desirable in order to achieve global roaming and the benefits of economies of scale. Given that over 90 countries have already identified 3 400- 3 600 MHz for IMT and more countries have indicated their intention to provide a similar identification at WRC-15 in this and adjacent frequency bands, an identification to IMT in the 3 600-3 700 MHz frequency bands offers great opportunity for harmonization. The United States, for example, is considering mobile broadband deployment in the band 3 550-3 700 MHz while other Region 2 countries are considering deployments in 3 400-3 600 MHz or 3 500-3 700 MHz. Application of the power flux-density limit and No. **9.21** provides for protection of the existing services. Additionally, Nos. **9.17** and **9.18** mandate coordination between terrestrial stations in the mobile service (e.g., IMT) and FSS earth stations, thereby addressing the remote possibility of cross-border interference.