ATTACHMENT A
to FCC Public Notice DA 16-1216

Recommendations presented at
October 24, 2016, Meeting of the
World Radiocommunication Conference Advisory Committee

Maritime Aeronautical and Radar Services

Document WAC/007(24.10.16)

UNITED STATES OF AMERICA

DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.8: to consider possible regulatory actions to support Global Maritime Distress Safety Systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS, in accordance with Resolution **359** (**Rev.WRC-15**)

BACKGROUND: Resolution **359 (Rev.WRC-15)** of WRC-19 Agenda Item 1.8, *"Consideration of regulatory provisions for updating and modernization of the Global Maritime Distress and Safety System"*, concerning GMDSS has two elements, *resolves* 1 addresses the modernization of the GMDSS, *resolves* 2 addresses the introduction of additional satellite providers into the Global Maritime Distress and Safety System (GMDSS). The view below addresses the "introduction of additional satellite systems" aspect of Agenda Item 1.8 and *resolves 2* of Resolution **359 (Rev.WRC-15)**.

Resolution **359 (Rev.WRC-15)** takes into consideration the activities of the International Maritime Organization (IMO) related to the introduction of additional satellite systems into the GMDSS, recognizing that that IMO has received an application to recognize an existing satellite system as part of the GMDSS. Further, *resolves* 2 of Resolution **359 (Rev.WRC-15)** invites ITU-R to conduct studies, including consideration of the mobile-satellite service (MSS) allocations used and the potential impact of possible modifications to the provisions of the Radio Regulations on sharing and compatibility with other services and systems in the frequency band and adjacent frequency bands.

Noting that activities in the IMO to recognize an additional satellite system as part of GMDSS are underway, and that consideration of this matter in the ITU-R is also underway, the United States provides its view below.

U.S. VIEW: With respect to Agenda Item 1.8, the United States supports the activities of IMO related to the introduction of additional satellite systems into the GMDSS, as well as activities underway in the ITU-R. Based upon successful conclusion of these activities, the United States supports appropriate modification of the Radio Regulations to provide for introducing additional satellite systems into the GMDSS.

Document WAC/008(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.9.1: regulatory actions within the frequency band 156-162.05 MHz for autonomous maritime radio devices to protect the GMDSS and automatic identifications system (AIS), in accordance with Resolution 362 (WRC-15)

BACKGROUND: RESOLUTION 362 (WRC-15) *"Autonomous maritime radio devices operating in the frequency band 156-162.05 MHz",* prescribes a study process for WP5B in four parts: 1) to determine the spectrum needs for the devices, 2) to categorize the various kinds of devices, 3) to conduct sharing and compatibility studies to ensure that no undue constraints are placed on the GMDSS and the AIS, and 4) to conduct studies to determine potential regulatory actions and appropriate frequencies within the band 156-162.05 MHz.

There is a need to recognize new autonomous maritime radio devices applications that aid navigation safety, safety communications and the maritime environment in an orderly and internationally-recognized way while limiting those that would hinder the safety applications of the GMDSS and AIS. Those new applications can be considered within the framework of ITU-R studies. The operation of autonomous maritime radio devices operating in the band 156-162.05 MHz should not constrain the frequencies designated for the GMDSS and AIS.

U.S. VIEW: The United States supports the ITU-R studies prescribed in Resolution 362 (WRC-15) and these studies should also take into account the protection of the GMDSS and AIS.

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Document WAC/009(24.10.16)

UNITED STATES OF AMERICA

DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.9.2: modifications of the Radio Regulations, including new spectrum allocations to the maritime mobile-satellite service (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125-157.4375 MHz and 160.6125-162.0375 MHz of Appendix 18, to enable new VHF data exchange (VDES) satellite component, while ensuring that this component will not degrade the current terrestrial components, applications specific messages (ASM) and AIS operations and not impose any additional constraints on existing services in these and adjacent frequency bands as stated in *recognizing d) and e)* of Resolution 360 (Rev. WRC-15).

BACKGROUND: RESOLUTION 360 (REV. WRC-15) *"Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunications",* invites ITU-R to conduct, as a matter of urgency, and in time for WRC-19, sharing and compatibility studies between VDES satellite components and incumbent services in the same and adjacent frequency bands specified in *recognizing d) and e)* to determine potential regulatory actions, including spectrum allocations to the MMSS (Earth-to-space and space-to-Earth) for VDES applications. To this end, the ITU-R has initiated sharing studies between the proposed VDES satellite (VDE-SAT) frequencies and the incumbent services in the same and adjacent bands so that this component does not impose any additional constraints on existing services in these and adjacent frequency bands as stated in recognizing d) and e) of Resolution 360 (Rev. WRC-15). The United States believes that the satellite component of the VDES could be beneficial towards enhancing maritime navigation and safety related applications on a global basis.

U.S. VIEW: The United States supports the ITU-R studies prescribed in Resolution 360 (Rev. WRC-15) and these studies should also take into account the protection of existing terrestrial services which operate in these and adjacent frequency bands.

Document WAC/010(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.10 To consider the spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System (GADSS) in accordance with Resolution **426 (WRC-15).**

BACKGROUND: While air travel in recent years has represented some of aviation's safest years in terms of the number of accidents, the tragedy of Malaysia Airlines flight 370 in March 2014 highlighted needed improvements in the global air navigation system requiring urgent attention. To address these improvements, the aviation community embarked on a global effort to develop a Global Aeronautical Distress and Safety System (GADSS), and ICAO forged consensus among its Member States and the international air transport industry on the near-term priority for a more comprehensive method of tracking civilian airline flights, regardless of their global location or destination. The ICAO Second High-level Safety Conference of 2015 (HLSC 2015) recommended that ICAO encourage States and the ITU to address the allocation requirements at WRC-15 necessary to provide a frequency spectrum allocation to enable global air traffic services (ATS) surveillance. The HLSC 2015 also endorsed a concept of operations to support the future development of the GADSS. It is envisaged that GADSS will address issues such as: aircraft tracking requirements under normal and abnormal conditions; autonomous distress tracking; automatic deployable flight recorder; and procedures and information management. Resolution **426 (WRC-15)** invited the ITU-R to conduct relevant studies taking into account information provided by ICAO on the requirements for both the terrestrial and satellite components of GADSS.

U.S. VIEW:

1. That the quantification and characterization of the radiocommunications requirements for both the terrestrial and satellite components of GADSS are the responsibility of ICAO;
2. That based on those requirements, relevant studies should be conducted in the ITU-R to review existing regulatory provisions and determine if additional regulatory changes are needed;
3. That ITU-R studies should be done in coordination with ICAO.

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Terrestrial Services

Document WAC/011(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.11: to take necessary actions, as appropriate, to facilitate global or regional harmonized frequency bands to support railway radiocommunication systems between train and trackside within existing mobile service allocations, in accordance with Resolution **236 (WRC-15)**

BACKGROUND: Railway radiocommunication systems between train and trackside (Rail RSTT) carry train control, command, and operational information as well as monitoring data between on-board radio equipment and related radio infrastructure located along trackside. World Radiocommunication Conference (WRC) 2019 agenda item 1.11 and associated ITU-R Resolution 236 (WRC-15) were developed out of an effort by some administrations to harmonize spectrum for railway radiocommunications systems between train and trackside for command and control.

U.S. VIEW: Supports studies under Resolution 236 (WRC-15) regarding the possible harmonization of frequency bands within existing land mobile service allocations for the implementation of railway radiocommunication systems between train and trackside for traffic control, passenger safety and security for train operation. Studies towards regional and global harmonization can be satisfied by developing applicable ITU-R Reports and Recommendations. No change to the Radio Regulations is required under this agenda item.

Document WAC/012(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.12: to consider possible global or regional harmonized frequency bands, to the maximum extent possible, for the implementation of evolving Intelligent Transport Systems (ITS) under existing mobile-service allocations, in accordance with Resolution **237 (WRC-15)**

BACKGROUND: An Intelligent Transportation System (ITS) is uses communications and computing technologies to improve transportation applications such as safe driving and to enhance productivity through the integration of advanced communications technologies into the transportation infrastructure and into vehicles and other end users. ITS encompasses a broad range of wireless and wire line communications-based information and electronics technologies.

World Radiocommunication Conference (WRC) 2019 agenda item 1.12 and associated ITU-R Resolution 237 (WRC-15) was developed out of an effort by some administrations to harmonize spectrum for Intelligent Transport Systems (ITS). Since the ITU initiated studies on ITS in the 1990s, there have been many changes in the ITS environment, including the introduction/planned introduction of new technologies and use of various frequency ranges.

U.S. VIEW: Supports studies under Resolution 237 (WRC-15) regarding the possible harmonization of frequency bands for ITS applications under existing land mobile service allocations. Studies towards regional and global harmonization can be satisfied by developing applicable ITU-R Reports and Recommendations. No change to the Radio Regulations is anticipated to be required under this agenda item.

Document WAC/013(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.13: to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution **238 (WRC-15)**

BACKGROUND: Mobile broadband plays a crucial role in providing access to businesses and consumers worldwide. According to ITU statistics, "In developing countries, the number of mobile-broadband subscriptions continues to grow at double digit rates, reaching a penetration rate of close to 41 percent. The total number of mobile-broadband subscriptions is expected to reach 3.6 billion by end 2016."[1]

Mobile broadband users are also demanding higher data rates and are increasingly using mobile devices to access audio-visual content. The mobile industry continues to drive technological innovations in order to meet these evolving user demands. Research and development efforts from both industry as well as academia are facilitating the use of spectrum in bands above 6 GHz for mobile broadband. These efforts span the globe. Some countries and regions have also begun making spectrum available for mobile broadband applications in higher frequency bands in order to provide the benefits of these innovations to businesses and consumers worldwide.

In early 2012, ITU-R embarked on a program to develop "IMT for 2020 and beyond". In November 2015, ITU-R approved Recommendation ITU-R M.2083 "Framework and overall objectives of the future development of IMT for 2020", which highlights three key usage scenarios for IMT-2020: enhanced mobile broadband, massive machine type communications, and ultra-reliable and low latency communications. Recognizing the need to consider the spectrum in the range 24.25 to 86 GHz to support terrestrial IMT in higher frequency bands, while protecting existing services, World Radiocommunication Conference (WRC) 2015 approved WRC-19 agenda item 1.13. ITU-R, standards development organizations, and industry continue to progress the work on the development of IMT-2020.

[1] ICT Facts and Figures 2016, available at http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf

U.S. VIEW: Support studies under WRC-19 agenda item 1.13 and take appropriate action based on the results of these sharing and compatibility studies in accordance with Resolution 238 in the following bands:

- 24.25-27.5 GHz, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz, which have allocations to the mobile service on a primary basis; and
- 31.8-33.4 GHz, 40.5-42.5 GHz and 47-47.2 GHz, which may require additional allocations to the mobile service on a primary basis.

Document WAC/014(24.10.16)

UNITED STATES OF AMERICA

DRAFT PRELIMINARY VIEWS ON WRC-19

Agenda Item 1.14: to consider, on the basis of ITU-R studies in accordance with Resolution **160 (WRC-15)**, appropriate regulatory actions for high-altitude platform stations (HAPS), within existing fixed-service allocations

BACKGROUND: WRC-15 adopted Agenda Item 1.14 in order to facilitate access to broadband applications delivered by high-altitude platform stations ("HAPS"), taking into account ITU-R studies in accordance with Resolution **160** (WRC-15). A HAPS is a station on a platform such as a solar plane or airship at an altitude of 20 – 50 km and at a fixed point relative to the Earth. Resolution **160** invites the ITU-R to complete, for WRC-19, studies on the suitability of using existing HAPS identifications, taking into account their geographical and technical restrictions, and sharing and compatibility studies towards additional identifications for the use of gateway and fixed terminal links for HAPS in existing fixed allocations in the 38-39.5 GHz band on a global basis as well as 21.4-22 GHz and 24.25-27.5 GHz bands in Region 2.

No. 4.23 of the Radio Regulations provides: "Transmissions to or from high altitude platform stations shall be limited to bands specifically identified in Article **5** (WRC-12)" and today there is only one global identification for HAPS in the fixed service. That single global identification is for HAPS links in the 47.2-47.5 GHz band fixed-service allocation paired with the 47.9-48.2 GHz band fixed-service allocation. That identification is the only fixed identification for HAPS available in Region 2. Noting the issues for HAPS with rain fade in this frequency range, WRC-2000 agreed on a HAPS identification in the fixed service for the frequency band 27.9-28.2 GHz (HAPS-ground), paired with the frequency band 31.0-31.3 GHz (ground-HAPS), for twenty-three countries outside Region 2. At WRC-12, five countries (all outside Region 2) agreed to a HAPS identification within the fixed service for frequency bands 6 440-6 520 MHz (HAPS-to-ground) and 6 560-6 640 MHz (ground-to-HAPS), with a coordination requirement of 1000 km.

Demand for high-speed Internet access and broadband applications has risen dramatically since spectrum was first identified globally for HAPS. Meanwhile, technology has improved to the point that some entities are interested in using HAPS systems to provide broadband access to fixed locations in remote and underserved areas. WRC-15 recognized that technology evolution in solar panel efficiency, battery energy density, lightweight composite materials, autonomous avionics, and antenna design may improve HAPS viability. Using these innovative technologies, HAPS systems, deploying a service contour much greater than traditional cellular towers, could enable affordable, high-speed, broadband connectivity where today's ground network infrastructure has heretofore been unable to reach.

Spectrum harmonization and utilization is facilitated by common worldwide identifications. International regulatory flexibility enable improvements in global connectivity by encouraging national regulators to permit operation of higher-speed Internet access services over new, complementary platforms, while ensuring protection of existing services. Additionally, harmonization of spectrum promotes economies of scale and commonality of equipment.

U.S. VIEW: In order to facilitate the use of HAPS links on a global or regional level, the United States supports studies, in accordance with Resolution **160** (WRC-15), and appropriate WRC-19 action based on the results of these studies, including possible modifications to the existing provisions on HAPS identifications in the Radio Regulations and possible new HAPS identifications in the fixed service bands at 21.4-22 GHz and 24.25- 27.5 GHz in Region 2, and 38-39.5 GHz globally.

Document WAC/015(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.15: to consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275-450 GHz, in accordance with Resolution **767 (WRC-15**)

BACKGROUND: There are no present international allocations above 275 GHz in the ITU's Radio Regulations (RR's). RR No. **5.565** makes identifications for radio astronomy, earth exploration-satellite (passive) and space research (passive) services. Advances in microwave technology now make the practical use of this spectrum for communications and related uses to be a real possibility in the next decade or two. There are also many beneficial passive scientific uses of this spectrum (*See* Recommendation ITU-R RS.515-5 for satellite passive service applications for this band). Together, the bands enumerated for these three services in RR No. **5.565** cover the entire spectrum in the 275-450 GHz range. Consistent with RR No. **5.565**, frequencies for fixed and mobile use can be selected provided "all practicable steps" are taken to protect passive services.

Several ultra-high-speed data communication systems have been identified by other international standards bodies. While non-radio optical fiber systems are low cost considering equipment cost per unit of capacity and length, in some limited applications such technology has very high installation costs and cannot be installed quickly to restore service disruptions. For example, wideband terrestrial links in this band could be provide services such as cellular backhaul in places where alternative technologies are not feasible. Other active services, including the radiolocation service and the amateur service, are also developing and demonstrating applications above 275 GHz.

The nature of the spectrum above 275 GHz is very different than lower bands. At these frequencies atmospheric absorption is a key propagation issue that affects inter-service compatibility. Such absorption is both highly frequency dependent and altitude dependent, and would need to be considered in evaluating protection. Thus absorption loss is lower in the zenith direction than for signals traveling at low elevation angles which pass longer distances in the lower atmosphere. The millimeter and submillimeter wavelengths in this band allow the use of modest sized directional antennas that can limit their transmissions in azimuth and elevations to a much greater degree than has been possible at lower bands where previous deliberations on passive/active sharing have taken place. Additionally, intermittent long distance propagation modes such as ducting do not exist at this frequency range. Another factor to take into account for potential sharing is that most potential terrestrial uses of this spectrum may not require high elevation angles which would limit radiated power distribution to tightly regulated elevation levels that would need to be considered for facilitating band sharing without impacting other desired uses.

Report ITU-R RA.2189 "Sharing between the radio astronomy service and active services in the frequency range 275-3 000 GHz" indicates that the radio astronomy service can share with terrestrial systems due to propagation issues and power limitations of current technology. For similar reasons, the space research service (passive) may also be able to share with terrestrial communications uses while on the other hand there is no study as of yet of the sharing issues between the Earth exploration-satellite service (passive) and terrestrial use.

RR No. **5.565** identifies nine bands covering 124 of the 175 GHz between 275 and 450 GHz for both earth exploration-satellite service (passive) and space research service (passive). Between these nine bands, there are eight gaps ranging from 5 to 10 GHz bandwidth with no EESS (passive) or SRS (passive) identification amounting to 52 GHz of the 175 GHz.

Since the EESS (passive) and SRS (passive) are satellite-based systems, terrestrial fixed and mobile systems that are designed to keep their transmitted power away from the geostationary satellite orbit by either using frequencies that have high atmospheric absorption such that they cannot impact the satellite or by avoiding illumination of the passive sensor on the satellite through use of highly directional antennas could also be used as a mechanism to potentially share spectrum with these passive systems. For terrestrial fixed applications, tight control of transmission directionality in shared bands is easier than for mobile applications. However, there may be certain blocks of passive where retaining the exclusive passive use is the only practical approach due to the nature of the specific observations in those bands. To protect observations from non-geostationary satellite orbits, alternative spectrum access techniques may be possible.

U.S. VIEW: The United States supports studies on sharing and compatibility between passive and active services as well as spectrum needs for those services in the ITU-R for WRC-19 agenda item 1.15 under the terms of Resolution **767 (WRC-15)**. The U.S. will take into account the results of those studies to consider supporting identification of spectrum at WRC-19 in the frequency range 275-450 GHz for land-mobile and fixed service applications while maintaining protection of the passive services identified in RR No. **5.565**.

Document WAC/016(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 9.1/Issue 9.1.2: Compatibility of International Mobile Telecommunications and broadcasting-satellite service (sound) in the frequency band 1 452-1 492 MHz in Regions 1 and 3

BACKGROUND: In Region 2, the 1452-1492 MHz frequency band is allocated on a co-primary basis to the Fixed, Mobile, Broadcasting, and Broadcasting-Satellite services. In addition, the 1427-1518 MHz frequency range is identified for International Mobile Telecommunications (IMT) in Region 2 via No. **5.431B** while No. **5.343** regarding Aeronautical Mobile Telemetry also applies.

World Radiocommunication Conference 2019 (WRC-19) agenda item 9.1/ issue 9.1.2 addresses the compatibility of IMT and Broadcasting-Satellite service (sound) in the frequency band 1 452-1 492 MHz in Regions 1 and 3. Region 2 should not be impacted by, or subject to any regulatory changes, as a result of WRC-19 agenda item 9.1/issue 9.1.2.

U.S. VIEW: Studies under WRC-19 agenda item 9.1/ issue 9.1.2 are limited to Regions 1 and 3. Any changes made to the Radio Regulations under WRC-19 agenda item 9.1/issue 9.1.2 must not impact Region 2 services (and applications thereof) nor subject Region 2 to any changed procedural or regulatory provisions.

Document WAC/017(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 9.1/Issue 9.1.5: Consideration of the technical and regulatory impacts of referencing Recommendations ITU R M.1638-1 and ITU R M.1849-1 in Nos. 5.447F and 5.450A of the Radio Regulations

BACKGROUND: Radio Local Area Networks have proven to be a tremendous success in providing affordable and ubiquitous broadband access to the Internet. Introduced by some administrations in the 2.4 GHz band and subsequently expanded into the 5 GHz band. RLANs, specifically "Wi-Fi" devices, now carry approximately half of all global IP traffic.

WRC-03 allocated the 5150-5350 MHz and 5470-5725 MHz bands to the mobile service on a primary basis for the implementation of Wireless Access Systems (WAS) including RLANs subject to Resolution 229. WRC-03 also decided that stations in the mobile service cannot claim protection from the radiolocation service, the Earth exploration-satellite service (active) and the space research service (active) (**RR No.** 5.447F) and the radiodetermination service (**RR No.** 5.450A) subject to protection criteria based on Recommendations ITU R M.1638-0 and ITU R RS.1632-0, which were incorporated by reference. Since WRC-03, billions of RLAN devices have been deployed in the 5 GHz band worldwide.

During the WRC-15 study cycle, Recommendation ITU-R M.1638-0 was revised. In this revision process, several new radars with different system characteristics were included in Recommendation ITU-R M.1638-1 and M.1840-1. Consistent with the provisions of Resolution 27 (WRC-07), for an ITU-R Recommendation (e.g. ITU-R M.1638), the reference in the Radio Regulations shall continue to apply to the earlier version incorporated by reference until such time as a competent WRC agrees to incorporate the new version. Given the potential impact on the widespread deployment of RLANs in the 5250-5350 MHz and 5470-5725 MHz and the provisions of **RR No.** 5.447F and **RR No.** 5.450A, WRC-15 decided to study this matter under WRC-19 agenda item 9.1/ issue 9.1.5.

U.S. VIEW: Support studies under WRC-19 agenda item 9.1/ issue 9.1.5 to determine the technical and regulatory impact of referencing Recommendations ITU-R M.1638-1 and ITU-R M.1849-1 in **RR No.** 5.447F and **RR No.** 5.450A, which pertain solely to the Mobile service, with the objective to ensure that no undue constraints are imposed on RLAN operations.

Space Services

Document WAC/018(24.10.16)

UNITED STATES OF AMERICA

DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.5: to consider the use of the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) by earth stations in motion communicating with geostationary space stations in the fixed-satellite service and take appropriate action, in accordance with Resolution **158 (WRC-15)**

BACKGROUND: Recognizing the increasing need for communications on the move, including the availability of global broadband satellite services, WRC-15 adopted Agenda Item **1.5** for WRC-19 to consider the operation of Earth Stations in Motion (ESIM) in the 27.5-29.5 GHz (Earth-to-space) and 17.7-19.7 GHz (space-to-Earth) fixed-satellite service (FSS) frequency bands with geostationary (GSO) space stations. In addition to being adjacent to the frequency bands where FSS ESIM operations are allowed, it was also recognized that GSO FSS satellites are operating in these bands and in some cases are already communicating with ESIM or plan to expand their use to include such operations. Today the Radio Regulations allow ESIMS to operate with GSO FSS space stations in the frequency bands 29.5-30.0 GHz (Earth-to-space) and 19.7-20.2 GHz (space-to-Earth) under footnote No. **5.527A** and Resolution **156,** which provides a framework for the operation of ESIMs globally with GSO FSS satellites in these bands.

ESIMs currently serve a wide range of applications on-board aircraft and ships as well as on land and the number of users and data requirements are growing. ESIM-delivered services are key to government users and enterprise users in many sectors including maritime shipping, media and energy customers who often have to operate in very remote parts of the world. The expectation of the user is to be able to be connected anywhere and broadband global satellite service is a key component on how to meet that expectation. One example of how demand for ESIM-type services is growing, can be seen in the in-flight connectivity market where ESIM are being installed on an increasing number of aircraft in order to provide air travelers enhanced on-demand entertainment options as well as allowing them to create a virtual office on the aircraft.

Considering that the growing demand for broadband communications includes requirements for users on vessels, aircraft and vehicles at fixed locations and while in motion, Resolution **158 (WRC-15)** invites ITU-R to study the technical and operational characteristics and user requirements of different types of earth stations in motion that operate or plan to operate within geostationary FSS allocations in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz. This includes the use of spectrum to provide the envisioned services to various types of earth stations in motion and the degree to which flexible access to spectrum can facilitate sharing with other services allocated in these bands. The Resolution also invites study of the sharing and compatibility between earth stations in motion operating with geostationary FSS networks and current and planned stations of existing services allocated in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz to ensure protection of, and not impose undue constraints on, services allocated in those frequency bands.

U.S. VIEW: Support studies under the terms of Resolution **158 (WRC-15)** on sharing and compatibility between ESIMs and current and planned stations of existing services allocated in the frequency bands 17.7-19.7 GHz and 27.5-29.5 GHz, while ensuring protection and not imposing undue constraints on these allocated services, and to take appropriate action based on the results of these studies.

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Document WAC/019(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 1.6 to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), in accordance with Resolution **159** (**WRC-15**)

BACKGROUND: Article **22** of the Radio Regulations contains provisions to ensure compatibility of non-GSO FSS operations with GSO networks for the 14/11 GHz and 30/20 GHz bands. Among these provisions are uplink and downlink equivalent power flux density (epfd↑ and epfd↓) limits to protect GSO networks from unacceptable interference pursuant to RR No. **22.2**. These measures contribute to provide a well-defined regulatory framework for non-GSO systems operating in the 14/11 and 30/20 GHz frequency bands. There are currently no regulatory provisions for sharing between non-GSO systems and GSO networks in the 50/40 GHz frequency bands. Moreover, there are no existing mechanisms in the RR establishing coordination procedures applicable to non-GSO systems operating within the FSS allocations in frequency bands in the 37.5 to 51.4 GHz range, such as application of RR No. **9.12**. This also contributes to uncertainty among potential operators of non-GSO satellite systems in these bands.

To address these issues, WRC-15 established agenda item 1.6 for WRC-19: "to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space),in accordance with Resolution **159 (WRC-15)**" which invites the ITU-R membership to contribute to "Studies of technical, operational issues and regulatory provisions for non-GSO fixed-satellite services satellite systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space)."

Studies under this agenda item are needed to determine aggregate epfd limits necessary to protect GSO-satellite networks, determine conditions appropriate for sharing the spectrum and orbit resources among non-GSO satellite systems, and ensure protection of the EESS and RAS. Additionally, Article 21 of the Radio Regulations addresses terrestrial and space services sharing frequency bands above 1 GHz. In this regard, it is important to note that Resolution **159 (WRC-15)** resolves that there will not be any modification to the provisions of Article 21 under this agenda item.

Non-GSO FSS systems in the 50/40 GHz band can be utilized to unlock a new and promising source of global broadband communications. Recent advances in satellite design, launch service capabilities and user terminal technology make it feasible to provide global satellite broadband services. Thanks to these recent technological advances, next-generation non-GSO satellite systems are currently being developed. These systems can greatly enhance the efficient use of existing FSS spectrum by using next-generation satellite and earth station technology. The benefits of such non-GSO satellite systems include providing worldwide connectivity and high-quality communication services to users in all geographic settings, be they urban, rural or remote, and offer tools for definitively addressing the longstanding broadband gap. Developing a regulatory framework in the 50/40 GHz band will provide regulatory certainty to allow non-GSO satellite systems to efficiently operate in these existing FSS frequency bands, while protecting GSO and other existing services.

U.S. VIEW: The United States supports studies under WRC-19 Agenda Item 1.6 regarding the development of a regulatory framework for non-GSO satellite systems in the existing FSS allocations in the 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) frequency bands under the terms of Resolution **159 (WRC-15)** and to take appropriate action based on the results of these studies.

Document WAC/020(24.10.16)

UNITED STATES OF AMERICA
DRAFT PRELIMINARY VIEWS FOR WRC-19

Agenda Item 9.1, Issue 9.1. 3 Study of technical and operational issues and regulatory provisions for new non-geostationary-satellite orbit systems in the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz and 6 725-7 025 MHz frequency bands allocated to the fixed-satellite service, in accordance with Resolution **157** (**WRC-15**)

BACKGROUND: Article **22** of the Radio Regulations contains provisions to ensure compatibility of non-geostationary ("non-GSO") FSS operations with GSO networks. Among these provisions are uplink and downlink equivalent power flux density (epfd↑ and epfd↓) limits to protect GSO networks from unacceptable interference. Regulatory provisions in Article **22** for sharing between non-GSO FSS systems and GSO FSS networks operating in the 6/4 GHz frequency bands were based on a particular type of non-GSO system using highly-elliptical orbits (HEO). The epfd↓ limits in the 3 700-4 200 MHz (space-to-Earth) and epfd↑ limits in the 5 925-6 725 MHz (Earth-to-space) frequency bands did not take into account circular-orbit non-GSO and therefore are more stringent than in other FSS bands that did consider circular orbit non-GSO systems. Circular-orbit non-GSO systems have different interference geometries and time-varying operational characteristics, as compared to HEO systems.

Article **21** of the Radio Regulations contains provisions to ensure compatibility of non-GSO FSS operations with the fixed and mobile services. These provisions are in the form of pfd limits for non-GSO FSS systems. Similar to the sharing situations that led to the Article **22** epfd limits to protect GSO systems, the existing Article **21** pfd limits for 3 700-4 200 MHz were established based solely on sharing studies between HEO non-GSO systems and the fixed and mobile services.

To address the above issues, WRC-15 established Agenda Item 9.1, Issue 9.1.3 for WRC-19: to study technical and operational issues and regulatory provisions to enable new circular-orbit non-GSO networks in the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925- 6 425 MHz, and 6 725-7 025 MHz frequency bands allocated to the fixed-satellite service (FSS), while ensuring protection of primary GSO networks and fixed-service (FS) and mobile-service (MS) systems in accordance with Resolution **157 (WRC-15)**. Prior to establishment of this WRC-19 Agenda Item, no studies had been performed within the ITU-R to address sharing between circular-orbit non-GSO satellite systems and existing primary services operating in the 6/4 GHz frequency bands.

The 3700-4200 MHz and 4500-4800 MHz bands are globally allocated to provide C-Band FSS downlinks. 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 properties, such as low

rain fade and coverage of wide service areas, is extensively used worldwide. After several 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 or developed nations. 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. Additionally, the 6700-7075 MHz band is allocated to the FSS for use by feeder links of non-GSO mobile-satellite service (MSS) systems, in the space-to-Earth direction. The 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925- 6 425 MHz, and 6 725-7 025 MHz frequency bands are also allocated on a co-primary basis to the Fixed and Mobile Services.

Studies under this Resolution are necessary to determine pfd limits necessary to ensure the protection of the mobile service and fixed services, determine aggregate epfd limits necessary to protect GSO FSS systems, determine conditions for protection of feeder downlinks of non-GSO mobile-satellite service (MSS) systems, and determine conditions appropriate for sharing the spectrum and orbit resources among non-GSO satellite systems. Resolution **157 (WRC-15)** further resolves that the results of studies shall in no way change the protection criteria and protection levels defined in those criteria for the GSO FSS, the fixed service and the mobile service.

Recent advances in satellite design, launch service capabilities and user terminal technology bring the benefits within reach to provide global and harmonized broadband services from circular-orbit non-GSO systems. Thanks to these recent technological advances, next-generation non-GSO systems are currently being developed that can provide high-capacity broadband services to end users in all locations around the world.

Circular-orbit non-GSO FSS systems in the 6/4 GHz band could be utilized to provide a new and promising source of global broadband communications. These systems can greatly enhance use of FSS spectrum and orbit resources by using next-generation satellite and earth station technology such as advanced antenna designs, allowing for greater frequency re-use and greater antenna directivity. This will enable efficient use of the existing 6/4 GHz FSS frequency allocations, while providing worldwide connectivity to provide high-quality communication services to users in all geographic settings, be they urban, rural or remote. Such next-generation circular-orbit non-GSO systems offer solutions to help address the longstanding broadband gap. Developing an appropriate regulatory framework in the 6/4 GHz bands, while ensuring the protection of other existing services and applications, will provide regulatory certainty to allow circular-orbit non-GSO systems to efficiently operate in these existing FSS frequency bands.

U.S. VIEW: The United States supports the study of a regulatory framework, under the terms of Resolution **157 (WRC-15),** to enable circular-orbit non-GSO FSS satellite systems to operate in the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz and 6 725-7 025 MHz frequency bands, while ensuring the protection of existing services and applications, and to take appropriate action based on the results of these studies**.**

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Agenda Item 9.1, Issue 9.1.9 Studies relating to spectrum needs and possible allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space), in accordance with Resolution **162** (**WRC-15**)

BACKGROUND: Resolution **162 (WRC-15)** states that "satellite systems are increasingly being used to deliver broadband services and can help enable universal broadband access...and that technological developments such as spot-beam technologies and frequency reuse are used by the fixed satellite service in spectrum above 30 GHz to increase the efficient use of spectrum." Next generation high throughput satellites (HTS) GSO and non-GSO satellite networks both plan to utilize these technologies to deliver high-capacity broadband services.

Currently, 1 GHz of existing FSS uplink allocation at 42.5-43.5 GHz is not practicable for broadband FSS networks to use assuming they operate downlinks in the immediately adjacent space-to-Earth FSS frequency allocation below 42.5 GHz. Such adjacent band use is not viable due to prohibitive cost and technical obstacles. This leaves an imbalance of spectrum available for broadband applications between downlink and uplink FSS spectrum in the 50/40 GHz frequency ranges with 5 GHz of spectrum currently allocated to FSS in the space-to-Earth direction, but only 4 GHz of usable spectrum allocated to FSS in the Earth-to-space direction.

Access to an adequate amount of uplink and downlink spectrum would facilitate the opportunity for next generation FSS networks to provide broadband communication services and connectivity to users worldwide. To address the issue, WRC-15 established WRC-19 Agenda Item 9.1, Issue 9.1.9 to study the spectrum needs and possible allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space), in accordance with Resolution **162** (**WRC-15)**. *Resolves to invite ITU-R* 1 of Resolution **162 (WRC-15)** states: "to conduct, and complete in time for WRC-19, studies considering additional spectrum needs for development of the fixed-satellite service, taking into account the frequency bands currently allocated to the fixed-satellite service, the technical conditions of their use, and the possibility of optimizing the use of these frequency bands with a view to increasing spectrum efficiency." It should be also noted *resolves to invite ITU-R* 2 of Resolution **162 (WRC-15)** states: "subject to justification resulting from studies conducted under *resolves to invite ITU-R* 1, sharing and compatibility studies with existing services, on a primary and secondary basis, including in adjacent bands as appropriate, to determine the suitability, including protection of fixed and mobile services, of new primary allocations to the FSS in the frequency band 51.4-52.4 GHz (Earth-to-space) limited to FSS feeder links for geostationary orbit use, and the possible associated regulatory actions." Studies related to *resolves* 2 of Resolution **162 (WRC-15)** should take into account the FSS GSO spectrum needs as appropriate. It is important to note that since WRC-19 AI 9.1.9 is

seeking an allocation limited to GSO feeder links, there will still be an imbalance of spectrum available for non-GSO satellite networks.

Thus, the review of the spectrum needs for the FSS under *Resolves to invite ITU-R* 1 of Resolution **162 (WRC-15)** should consider all aspects of FSS operations. Next generation GSO and non-GSO FSS satellite networks can leverage innovative new satellite and earth station technologies to provide a wide range of advanced communications services for residential, commercial, institutional, and large-scale professional users worldwide. These satellite networks plan to provide data rates from 100 bps to greater than 1 Gbps on a single channel, while achieving highly efficient use of the spectrum and orbit resources. Adequate balanced uplink and downlink spectrum for GSO and non-GSO FSS networks utilizing these state-of-the art technologies will be crucial to enable provision of much needed broadband services and other communications services via satellite simultaneously to all users, regardless of location.

U.S. VIEW: The United States supports the study of all aspects of spectrum needs for the development of the fixed-satellite service under *Resolves 1* of Resolution **162**. The United States further supports the study as appropriate of possible primary allocation to the FSS of the frequency band 51.4-52.4 GHz (Earth-to-space), limited to GSO FSS feeder links, under the terms of Resolution **162 (WRC-15)** to ensure compatibility with existing services, including adjacent bands as appropriate. Such studies should determine the suitability, including protection of fixed and mobile services, of a new primary allocation to the FSS in the frequency band 51.4-52.4 GHz (Earth-to-space), limited to FSS feeder links for geostationary orbit use, and the possible associated regulatory actions based on the results of these studies.

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Agenda Item 10: to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, in accordance with Article 7 of the Convention - Resolution **810 (WRC-15)** Preliminary agenda for the 2023 World Radiocommunication Conference.

BACKGROUND: Resolution **810 (WRC-15)** provides the Preliminary agenda for the 2023 World Radiocommunication Conference. No. 118 of the ITU Convention provides that the general scope of WRCs should be established four to six years in advance. Among a number of preliminary WRC-23 agenda items, WRC-15 resolved to give the view that WRC-19, on the basis of proposals from administrations and the Report of the Conference Preparatory Meeting, and subject to the results of WRC-19, should consider and take appropriate action in respect toWRC-23 Agenda Item 2.4:

> "2.4 study of spectrum needs and possible new allocations to the fixed-satellite service in the frequency band 37.5-39.5 GHz (Earth-to-space), in accordance with Resolution **161 (WRC-15)**;"

This same frequency band is also the subject of several WRC-19 agenda items, including1.13 and 1.14 that will consider identification of this frequency band (among others) for the terrestrial component of International Mobile Telecommunications (IMT) and High-Altitude Platform Systems (HAPS) respectively.

Subsequent to WRC-15, the 2016 Session of the ITU Council adopted Resolution 1380, thereby adopting the place, dates, and agenda of WRC-19, including the recommended agenda for WRC-23.

DISCUSSION: Today satellite operators provide a wide range of broadband services to a rapidly growing customer base, with more systems to come before 2019. There is growing demand for fixed-satellite services ("FSS"), which in many rural and remote locations are the only ways of receiving such important broadband and data communication services. Today, with C, Ku and Ka bands reaching capacity, satellite frequencies are heavily used and are nearing saturation for many applications. Consequently, satellite operators are seeking access to additional fixed-satellite service spectrum to satisfy existing and anticipated requirements for existing and new broadband services. In North America, for example, over one million and a half customers currently rely on satellite broadband services and that number is growing each day.

Advances in satellite technologies are allowing the provision of a variety of new services including innovative broadband, video and mobile services, covering all corners of the globe, and allowing service to places and regions that may not covered by traditional terrestrial services and that, accordingly, may miss out on the benefits of new and innovative telecommunications services. Technological innovation in radio communication is enabling satellite technology that offers much more capacity compared to before, even within existing spectrum. This applies to the fixed-satellite service whether operating in the geostationary or non-geostationary orbits. The satellite industry takes this development into account by using the most spectrum efficient technologies, including advances in spot-beam technologies, frequency re-use, and through the use of techniques such as reverse band operation which, for example, is intended to be deployed in the frequency band that is the subject of this preliminary view. In addition, for some satellite applications, such as gateways, sharing with other radio services could be more easily accomplished. Nevertheless, even with technological innovation and increased efficiency, demand for fixed-satellite service outpaces the spectrum available for the service today.

For WRC-15, the Inter-American Telecommunication Commission (CITEL) proposed (1) the 32.3-33 GHz frequency band to be allocated to the fixed-satellite service, and (2) the 37.5-39.5 GHz frequency band, which is already allocated to the fixed-satellite service in the space-to Earth direction, also be allocated for reverse direction operations (Earth-to-space) for gateway earth stations. In the course of WRC-15 negotiations, the 32.3-33 GHz band was dropped from further consideration. Ultimately, WRC-15 recommended that WRC-23 address the 37.5-39.5 GHz band in accordance with Resolution **161 (WRC-15)**.

U.S. VIEW: Subject to the results of WRC-19, support studies under the terms of WRC-23 Agenda Item 2.4, Resolution **161 (WRC-15)** to determine additional spectrum needs for the fixed-satellite service and compatibility of FSS with current and planned stations of existing services, and to take appropriate action based on the results of these studies.

Regulatory Issues

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Agenda Item 1.4: to consider the results of studies in accordance with Resolution **557 (WRC-15)**, and review, and revise if necessary, the limitations mentioned in Annex 7 to Appendix **30 (Rev.WRC-12)**, while ensuring the protection of, and without imposing additional constraints on, assignments in the Plan and the List and the future development of the broadcasting-satellite service within the Plan, and existing and planned fixed-satellite service networks;

BACKGROUND: Appendix **30** contains provisions for use of the broadcasting-satellite service (BSS) Plans and Regions 1 and 3 List, as well as for modifying the Plan (in the case of Region 2) or the List (in the case of Regions 1 and 3). It is a self-contained Appendix, including provisions for modifying the Plan or List (Article 4), notifying Plan or List assignments (Article 5) and for coordinating other services in the frequency bands vis a vis the Plan and List (Articles 6 and 7).

Appendix **30** also contains detailed criteria for sharing between the Plan/List and other services. Specifically, Annex 1 to Appendix **30** provides criteria for determining whether the assignments of an administration are affected by a proposed modification to the Region 2 Plan or by a proposed new or modified assignment in the Regions 1 and 3 List; Annex 4 to Appendix **30** provides criteria to determine the need to coordinate the fixed-satellite service (FSS) (or BSS not subject to a Plan) with the assignments of the Plans; and finally Annex 7 to Appendix **30** contains orbital position limitations on modifications to the BSS Plan or List.

The Ku-band frequencies are not globally harmonized; so, for example, the range 11.7-12.2 GHz is BSS in Region 1 and FSS in Region 2, the range 12.5-12.7 GHz is FSS in Region 1 and BSS in Region 2, and the range 12.2-12.5 GHz is BSS in both Regions 1 and 2. The Annex 7 orbital position limitations on modifications to the BSS Plan or List were designed to facilitate BSS sharing with the FSS in the shared part of the orbital arc between Regions 1 and 2, and are specifically applicable to Region 2 BSS in 12.2-12.7 GHz and to Region 1 BSS in 11.7-12.2 GHz.

The Annex 7 orbital position limitations were maintained at WRC-2000 (the most recent BSS Planning conference, which focused on Regions 1 and 3) for the reason that during a Planning conference, many new BSS slots could be adopted at once, which could significantly limit the future access of FSS to the shared portion of the orbital arc. Some of the criteria of Annex 1 and Annex 4 to Appendix **30** were updated at WRC-2003. Since then there has been considerable experience in working with the Plans and the criteria of Annexes 1 and 4 to Appendix **30**.

On-going ITU R studies reported that the provisions for Region 2 BSS in Annex 7 to Appendix 30 may no longer be required, and in consequence WRC-15 adopted Agenda Item 1.4 to consider the results of studies in accordance with Resolution **557 (WRC-15)** to review the limitations mentioned in Annex 7 to Appendix **30** and see if they could be removed or modified to provide additional access to this valuable spectrum resource. It is envisioned that studies will assess each portion of the orbital position limitations in Annex 7 (including, e.g., the orbital positions in Section A2 applicable to Region 2 BSS) to determine whether each could individually be removed or modified.

U.S. VIEW: With respect to Agenda Item 1.4, the United States supports the studies in accordance with Resolution **557 (WRC-15).** Based upon successful conclusion of these activities, the United States supports the review and revision, as necessary, of the limitations of Annex 7 to Appendix 30 **(Rev.WRC-12)**, while ensuring the protection of existing assignments in the Plan and the List and the future development of BSS service within the Plan, and existing and planned fixed-satellite service networks.