

SPECTRUM MANAGEMENT TASK FORCE (SMTF)

WRC-27 Agenda Item Backgrounds

Purpose

To provide the background of the listed WRC-27 Agenda Items for enhanced context and understanding

Action Required

This document is submitted for review and consideration to the Spectrum Management Task Force.

Submitted by

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WRC-27 Agenda Item Background

1.1 - Previous WRC's have addressed the spectrum needs and use of aeronautical and maritime ESIM, which includes the adoption of technical and regulatory requirements to allow such operations. In the Radio Regulations, Resolutions 902 (WRC-03), 156 (WRC-15), 169 (WRC-19), 121 (WRC-23) and 123 (WRC-23) define technical and regulatory rules to allow ESIM communicating with GSO FSS networks and/or non-GSO FSS systems to provide broadband communications in various frequency bands.

Resolution 176 (Rev.WRC-23) calls for studies on possible use of frequency bands 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), or parts thereof, by aeronautical and maritime earth stations in motion to communicate with space station in the fixed-satellite service. These studies should assess the spectrum needs for additional A-ESIMs and M-ESIMs, as well as the sharing and compatibility with the services allocated in these frequency bands (and adjacent) on a primary basis. Given Resolution 176 considers both the use of GSO and NGSO ESIMs, the aggregate impact should be accounted for in the studies.

Under Resolution 176 (Rev. WRC-23), Agenda Item 1.1 considers the frequency band 47.2-50.2 GHz for FSS (Earth-to-space) NGSO A-ESIM and M-ESIM operations. This band is often paired with the 37.542.5 GHz FSS (space-to-Earth) frequency band, which is not covered by Resolution 176 and is not addressed under this agenda item. It is noted that under RR No. 21.16.4, the applicability of the pfd limit values in Table 21-4, in the bands 37.5-40 GHz and 40.5-42.5 GHz, for space stations operating in NGSO systems with 100 or more satellites is subject to further study.

1.2 - The frequency band 13.75-14.0 GHz has been subject to regulatory and allocation changes over the years. WARC-92 added an allocation, further revised by WRC-03, to the FSS (Earth-to-space) in this band that impose requirements for minimum size of satellite earth station antennas operating in the 13.75-14 GHz band (1.2 m for geostationary satellite orbit (GSO) networks and 4.5 m for non-geostationary satellite orbit (non-GSO) systems) and on the maximum power flux density that an earth station can transmit towards the sea. WRC-03 introduced changes to Nos. 5.502 and 5.503 that made it possible to use earth station antennas of 1.2 meters for the GSO FSS networks. WRC-03 did not introduce any changes in Nos. 5.502 and 5.503 regarding earth station antennas for NGSO systems.

The purpose of these limitations is to protect the radiolocation and space research services. In addition to the fact that satellite technology has changed tremendously since these conditions were developed 20 years ago, there may also be changes in the SRS and RLS that operate in this band, their applications and co-existence conditions.

WRC-23 again identified the need for further studies to address the operational and technical limitations regarding the minimum antenna size and associated power limitations for GSO and NGSO FSS earth stations in the 13.75-14.0 GHz band. Resolution 129 (WRC-23) acknowledges the increasing demand for uplink spectrum by smaller antennas for earth stations and the necessity to review sharing conditions with the RLS and SRS to support the evolving needs of FSS applications efficiently and rationally.

1.3 – In accordance with Resolution 130 (WRC-23), WRC-27 agenda item 1.3 invites sharing and compatibility studies with existing services, including in adjacent bands, including protection of the fixed and mobile services, and studies relating to the suitability of revising conditions associated with the primary allocation to the FSS in the frequency band 51.4-52.4 GHz (Earth-to-space) to enable its use by gateway earth stations of non-GSO FSS systems (Earth-to-space), and the relevant regulatory studies.

The frequency band 51.4-52.4 GHz is allocated on a primary basis in the three Regions to the Fixed-Service and the Mobile Service and is available for high-density applications in the fixed service, as indicated in No. 5.547. The 50.2-50.4 GHz frequency band is also allocated to the Earth exploration-satellite service (EESS) (passive), with non-GSO FSS unwanted emission limits provided in Resolution 750 (Rev.WRC19). The 52.6-54.25 GHz band is similarly allocated to the EESS (passive). Consideration should be given to possibly revising Resolution 750 (Rev.WRC-19) to include the non-GSO FSS unwanted emission limit for the 52.6-54.25 GHz band and possibly modifying the GSO FSS unwanted emission limit for the same band, based on study results, considering the aggregation of interference into EESS (passive).

- 1.4 WRC-23 considered the need to encourage the development and implementation of new technologies in the fixed-satellite service (FSS) for delivery of broadband applications and the mismatch in usable downlink bandwidth in the FSS in Region 3 in the frequency range 17-20 GHz associated with the uplink frequency range of 27-30 GHz. The band 17.3-17.8 GHz is already allocated to the BSS (space-toEarth) in Region 1. The 17.3-17.7 GHz band is already allocated to the FSS (space-to-Earth) in Region 1 and coexists with BSS feeder links (Earth-to-space) that are subject to Appendix 30A. In addition, WRC23 agreed a new primary allocation to the FSS in the space-to-Earth direction in the frequency band 17.317.7 GHz in Region 2.
- 1.5 WRC-23 resolved to invite the ITU-R to conduct studies on regulatory measures to limit the unauthorized operations of non-GSO FSS and MSS earth stations in the Earth-to-space

direction in order to address and cease such operations, taking into account technical and operational aspects, as appropriate. WRC-23 also invited the ITU-R to conduct studies on regulatory measures (taking into that Member States may wish to exclude their territories from the service area of non-GSO FSS and/or MSS satellite systems) and the implementability of such measures, without adversely affecting the provision of service in the rest of the service area of the nonGSO satellite system.

1.6 - to study the technical and regulatory measures for FSS satellite networks/systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), or portions thereof, for equitable access, while ensuring the protection of existing primary services to which the band is allocated in the same and adjacent bands, taking into account the specific needs of developing countries.

1.7 - The text of Resolutions 256 (WRC-23) calls for ITU-R to study the possible identification of specific additional frequency bands, or parts thereof, for IMT. All subject frequency bands to be studied are already allocated for the mobile service on a primary basis, so this agenda item does not include any additional mobile service allocations; however, as has been seen at previous WRCs, identifying a mobile service band for IMT can change the interference environment due to the unique and ubiquitous deployment of IMT. The frequency bands to be studied, and bands adjacent to those frequency bands in Resolution 256 (WRC-23) are already allocated and used by a variety of incumbent services/systems on a primary basis by many administrations, and studies are required to ensure the protection of existing and evolving needs of these incumbent services:

- 4 400-4 800 MHz: The frequency band 4 400- 4 800 MHz is allocated to fixed and mobile. Additionally, the 4 500-4 800 MHz is allocated to the fixed satellite service.

It should be noted that Resolution 256 (WRC-23) does not call for studies of the frequency band 4 400-4 800 MHz in Region 2.

1.8 – The frequency range 231.5-275 GHz includes several bands that are allocated to different radio services, particularly the radio location service in different categories, with the 238-248 GHz band on a primary basis and the 231.5-235 GHz band on a secondary basis, while the 235-238 GHz and 248-275 GHz frequency bands are currently not allocated to the radiolocation service. Therefore, there is some interest in having a harmonized spectrum globally for radiolocation service systems and applications, especially in the 231.5-320 GHz range, because of low atmospheric absorption.

Notwithstanding, various administrations around the world use some frequency bands within the 231.5-275 GHz frequency range for different radio communication services, including passive services such as RAS, EESS (passive) and SRS (passive). This requires protection against harmful interference and establishing specific conditions to enable them to continue operating.

1.9 – The High Frequency (HF) band has been identified as an effective alternative to provide much needed integrated and interoperable Beyond-Line-of-Sight (BLOS) communications capabilities. HF is also a critical and affordable option for global broadcasting and amateur radio, and an alternative when other communications services are unavailable due to natural disasters or other national emergencies. The challenge with meeting the growing requirement for modern HF is the need for the increased bandwidth allocations that would be required to achieve HF's advantages while not impeding the legacy frequency needs of incumbent users, groups, or countries. Appendix **26** of the ITU Radio Regulations limits Aeronautical Mobile (OR) Service (AM(OR)S) to a maximum bandwidth of 2.8 kHz.

1.10 - WRC-2000 adopted co-primary allocations in the 71-76 GHz and 81-86 GHz band for terrestrial (fixed and mobile services) and the fixed-satellite, mobile-satellite and broadcasting-satellite services. Due to technological readiness, however, administrations historically have deployed on the primary fixed service allocation in the 71-76 GHz and 81-86 GHz bands for high-capacity fixed wireless backhaul systems for point-to-point (P-P) applications. According to industry data, in the United States wireless data traffic exceeded 73.7 trillion megabytes, a 157% increase since 2018 and a 38% increase since 2021. To accommodate the growing demand for IMT services, wireless network deployments trend towards improving broadband coverage and increasing the availability of higher speeds to more subscribers. Ultimately, this translates in an increase of mobile broadband throughput and/or capacity.

As a result, new base stations are being designed to facilitate mounting on lamp posts and other street level structures. As it is difficult and costly to provide necessary backhaul connections using fiber to these structures, microwave links using the optimal characteristics of the 71-76 and 81-86 GHz bands are being deployed to support wideband integrated access backhaul solutions.

Recognizing the growing terrestrial use of the 70/80 GHz bands to support future mobile networks, and the increasing number of satellite filings in the frequency bands, WRC-23 agreed to study the protection of terrestrial services from satellites services, under agenda item 1.10 and Resolution 775.3 Accordingly, studies should be performed to determine the power flux-density (pfd) and equivalent isotropically radiated power (e.i.r.p.) limits to be included in Article 21 for satellite services (fixed-satellite service (FSS), mobile-satellite service (MSS) and broadcasting-

satellite service (BSS)) to protect the current and planned fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz.

1.11 - WRC-27 is considering taking appropriate regulatory actions for the provision of space-tospace links among non-geostationary and geostationary satellites in the frequency bands 1 5181 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660 MHz, 1 670-1 675 MHz and 2 483.5-2 500 MHz allocated to the mobile-satellite service to facilitate relaying data from nongeostationary (non-GSO) space stations through satellite systems or networks in the mobilesatellite service.

It is necessary to study the impact on, and to protect, other services, including Earth-to-space and spaceto-Earth operation within the MSS, from the operation of space-to-space links in the frequency bands included under this agenda item, taking into account applicable footnotes to the Table of Frequency Allocations, to ensure compatibility with incumbent services in these frequency bands and the adjacent frequency bands and avoid harmful interference. Studies will need to be conducted on the technical and operational characteristics, and protection, sharing and potential compatibility between satellite-tosatellite links and the allocated primary services in the frequency ranges and adjacent bands specified in Resolution 249 (Rev. WRC-23). These studies are underway in the ITU.

1.12 - studies on spectrum requirements, technical and operational characteristics and conditions for non-GSO low-data-rate MSS systems, including mitigation techniques, that allow coexistence of these systems in the same frequency bands;

studies on sharing and compatibility between the non-GSO low-data-rate MSS systems and the existing primary services operating in the frequency bands 1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space), 1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space) and in the relevant adjacent frequency bands, in order to ensure protection of existing services,

1.13 - As technologies evolve, terrestrial mobile network operators have been looking for ways to extend cellular coverage in order to keep users connected particularly in remote areas. Direct-to-cellular technologies promises to deliver mobile connectivity in previously unreachable areas and allows mobile network operators to extend their existing spectrum holdings to connect unmodified mobile handsets in unserved, or unreachable areas and in the wake of emergencies.

Resolution 253 (WRC-23) calls for studies to facilitate direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial

IMT network coverage. Sharing and compatibility studies in bands between 694 - 2 700 MHz identified for IMT in the Radio Regulations and reflected in Recommendation ITU-R M.1036 are essential to ensure the protection of incumbent services, including in adjacent frequency bands in accordance with the Radio Regulations. Resolution 253 (WRC-23) also calls for possible technical and operational measures to ensure that such envisaged space stations do not cause harmful interference nor claim protection from stations in the mobile service.

1.14 - Current and future MSS systems will deliver more robust voice and data communication applications representing a practical and effective method for delivering connectivity particularly in unserved and underserved areas, and enable access to essential information, educational resources, healthcare services, and economic opportunities. To address the additional MSS spectrum needs to support these benefits, WRC-27 agenda item 1.14 will study the sharing and compatibility between new MSS operations and incumbent services.

Resolution 254 (WRC-23) explores the feasibility of new MSS frequency allocations in the frequency bands 2 010-2 025 MHz (Earth-to-space) and 2 160-2 170 MHz (space-to-Earth) in Regions 1 and 3 and 2 120-2 160 MHz (space-to-Earth) in all Regions.

1.15 - WRC-27 AI 1.15 aims to address sharing/compatibility studies and spectrum needs related to systems in the space research service (SRS) planned for operations on the lunar surface, or systems in lunar orbit communicating with systems on the lunar surface, in specific frequency ranges, in accordance with Resolution 680 (WRC-23).

1.16 - In accordance with Resolution 681 (WRC-23), WRC-27 agenda item 1.16 invites studies on how the interference from unwanted emissions from non-GSO satellite systems operating in the adjacent bands to a set of RAS primary frequency bands affects the operation of RAS stations.

1.17 - Space weather events can cause harm to important sectors of national economies, security and human welfare. As such, space weather data is important, and regulatory protection is needed for space weather observation systems, including receive-only sensors that measure lowlevel emissions from sources such as the Sun, the Earth's atmosphere and other celestial bodies. Article 29B and Resolution 675 (WRC-23) defines space weather and designates space weather sensors to the meteorological aids service in the subset MetAids (space weather). However, no notification of frequency assignments to a station used for space weather observation be made by administrations under MetAids (space weather) until WRC-27 introduces the corresponding allocations in Article 5.. 1.18 - The WRC-2000 made various allocation changes to the frequency bands above 71 GHz, including primary allocations to the Earth exploration-satellite service (EESS) (passive) subject to No. 5.340, based on the requirements known at the time of that conference. Primary allocations have also been made to various active services in frequency bands adjacent to frequency bands above 86 GHz allocated to the EESS (passive) subject to No. 5.340. While some active systems are under development, in many of the bands above 76 GHz the planned use is still in a nascent state. As noted in Resolution 731, the sharing criteria for active and passive services in the frequency bands above 71 GHz have not been fully developed within the ITU and that to the extent practicable, the burden of sharing among active and passive services should be equitably distributed among the services to which allocations are made. Additionally, primary service allocations have been made in adjacent frequency bands to the radio astronomy service (RAS) and various space services, such as the fixed-satellite service (FSS), mobile-satellite service (MSS), broadcastingsatellite service (BSS), and radionavigation-satellite service (RNSS), in frequency bands above 76 GHz. In many cases, because the frequencies used by EESS (passive) sensors and stations of the RAS are chosen to study natural phenomena producing radio emissions at frequencies fixed by the laws of nature, it is not possible for EESS (passive) or RAS stations to shift frequencies to avoid or mitigate interference problems.

1.19 - For years, the frequency band 6 425 – 7250 MHz has been utilized by opportunistic use (i.e. no allocation) of the Earth exploration-satellite service (EESS) (passive) for operations carried out over oceans (see No. 5.458). EESS passive sensing may also be authorized in the frequency band 4 200-4 400 MHz on a secondary basis (see Radio Regulation (RR) No.5.437).

In accordance with Resolution 674 (WRC-23), WRC-27 agenda item 1.19 invites studies on the use of the EESS (passive) to perform sea surface temperature (SST) measurements for detecting and forecasting meteorological events in the complementary frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz. SST, together with ocean salinity, is one of the drivers of the ocean circulation, which is key for any numerical weather prediction (NWP) or numerical ocean prediction (NOP) models. SST is also a critical variable for climatological studies and for the assessment of global temperature trends, and it is fundamental to understand the exchanges of heat, gas and momentum between the atmosphere and the ocean, and in calculations of carbon uptake by the ocean from the atmosphere. Global maps of SST are also important for commercial applications such as fishery assessment.