

## **PRELIMINARY WMO POSITION PAPER ON WRC-23**

Attached to this document is the preliminary WMO position on agenda items of the World Radiocommunication Conference 2023 (WRC-23), as prepared by the WMO Steering Group for Radio Frequency Coordination (SG-RFC) at its 2020 meeting, held from 11 to 13 February 2020 (see <https://wiswiki.wmo.int/tiki-index.php?page=SG-RFC-2020>).

Among WRC-23 agenda items, seventeen items are related to frequency bands or issues of prime interest or concern for meteorology and the related fields.

- Agenda item 1.2:** International Mobile Telecommunications (IMT)
- Agenda item 1.3:** 3 600-3 800 MHz band for mobile service within Region 1
- Agenda item 1.4:** High-altitude platform stations as IMT base stations (HIBS)
- Agenda item 1.6:** Sub-orbital vehicles
- Agenda Item 1.10:** Possible new allocations for the aeronautical mobile service
- Agenda item 1.12:** Earth exploration-satellite service (active) around 45 MHz
- Agenda item 1.13:** Space research service allocation - 14.8-15.35 GHz
- Agenda item 1.14:** EESS (passive) in 231.5-252 GHz
- Agenda item 1.16:** Earth Stations in Motion (ESIMs)
- Agenda item 1.17:** Intersatellite links in specific frequency bands
- Agenda Item 1.18:** Potential new allocations to the MSS
- Agenda item 7:** Satellite regulatory procedures
- Agenda item 9.1a):** Space weather sensors
- Agenda item 9.1b):** Amateur service and amateur-satellite service allocations
- Agenda item 9.1c):** Study use of IMT for fixed wireless access
- Agenda item 9.1d):** Protection of EESS (passive)
- Agenda item 10:** Preliminary agenda for WRC-27

This document reflects the WMO position as of 6 April 2020 and is expected to be further refined prior to the 72nd session of the WMO Executive Council, which is set to be rescheduled later in 2020.

**Action proposed:** CGMS is invited to review the preliminary WMO position paper and to assist in making this information known to its members' national and international preparation processes for WRC-23.

## **Preliminary WMO Position on WRC-23 agenda**

### **1 INTRODUCTION**

In adopting the 2030 Agenda for Sustainable Development, world leaders agreed that a global indicator framework was necessary to progress towards the 17 transformational Sustainable Development Goals (SDGs) and 169 associated targets. Meteorological services have an essential role to play in relation to the most of them, such as zero hunger, life on the land, sustainable cities and communities, in particular<sup>1</sup>. Numerical weather forecasting, based on meteorological services, is one of the most important cornerstones to achieve substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries, as established by the UN Sendai Framework for Disaster Risk Reduction.

Timely warning of impending natural and environmental disasters, accurate climate prediction and detailed understanding of the status of global water resources: these are all critically important everyday issues for the global community. National Meteorological and Hydrological Services (NMHSs) around the world are responsible for providing this information, which is required for the protection of the environment, economic development (transport, energy, agriculture, etc) and the safety of life and property.

Radio-frequencies represent scarce and key resources used by National Meteorological and Hydrological Services to measure and collect the observation data upon which analyses and predictions, including warnings, are based or processed, and to disseminate this information to governments, policy makers, disaster management organizations, commercial interests and the general public.

Nowadays radio-based remote sensors (active and passive) are the main tools for environment and climate monitoring, disaster prediction and the detection and mitigation of negative effects of disasters. These sensors obtain environmental data by measuring level and parameters of natural and artificial radio waves that inherently contain information about the environment with which they have been in contact. Terrestrial and space-borne remote sensing applications form the backbone of the World Meteorological Organization (WMO) Integrated Global Observing System (WIGOS).

WMO information systems also make extensive use of radiocommunication systems and radio-frequency spectrum, and although they are also using

<sup>1</sup> See <https://public.wmo.int/en/our-mandate/what-we-do/wmo-contributing-sustainable-development-goals-sdgs>.

commercially provided services such as communication satellites for the distribution of data, meteorological related radiocommunication systems are an essential and indispensable component of WMO's critical data collection and distribution systems (e.g. Earth-to-space and space-to-Earth transmissions). WMO Members in remote or isolated areas are most dependent on these special services and will benefit most from many of the new initiatives such as wireless broadband that are putting new stress on the demand for spectrum bandwidth.

The Report of the International Telecommunication Union Radiocommunications sector (ITU-R) RS.2178, referred to in Resolution **673 (Rev. WRC-12)** on "The importance of Earth observation radiocommunication applications", concluded in particular that:

"Most of this societal value is incommensurable in financial terms, as it relates to preventing large loss of lives or threats to socio-political stability and security. The scientific use of spectrum has also a direct impact in many economic areas, which can be estimated by producing spin-offs in technology and economic developments in energy, transportation, agriculture, communications, etc."

The development of new, mass-market and value-added radio applications is putting increasing pressure on the frequency bands used for meteorological purposes. This presents the potential risk of limiting meteorological and other related applications in the future.

On a more general basis, the utmost importance of radiofrequencies for all Earth observation activities is also to be stressed. WMO in its role of coordinating observations, in particular with regard to global warming and climate change, is also an important Participating Organization of the intergovernmental Group on Earth Observations (GEO)<sup>2</sup>.

This document reflects the preliminary WMO position on the agenda of the World Radiocommunication Conference 2023 (WRC-23) as given in Resolution 811 (WRC-19) "Agenda for the 2023 World Radiocommunication Conference".

## 2 GENERAL COMMENTS

WIGOS comprises components that make use of a wide number of different radio applications and services, some of which may be affected by WRC-23 decisions.

<sup>2</sup> (Note: GEO has updated its approach, focus is less on SBAs, propose the following new text): The Group on Earth Observations (GEO) is an intergovernmental partnership that improves the availability, access and use of Earth observations for a sustainable planet. GEO promotes open, coordinated and sustained data sharing and infrastructure for better research, policymaking, decisions and action across many disciplines. The GEO community focuses on three global priority engagement areas: the United Nations 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction. The availability, reliability and protection of suitable frequency bands required for the operation of Earth observation systems is of critical importance to GEO, its 90 Member countries, its participating organizations and ultimately all citizens. Also, see [http://earthobservations.org/geo\\_wwd.php](http://earthobservations.org/geo_wwd.php).

Space-borne sensing of the Earth's surface and atmosphere has an essential and increasing importance in operational and research meteorology, in particular for mitigating the impact of weather, water and climate-related disasters, and in the scientific understanding, monitoring and prediction of climate change and its impacts.

The impressive progress made in recent years in weather, water and climate analysis and forecasts, including warnings for dangerous weather phenomena (heavy rain, storms, cyclones) that affect all populations and economies, is to a great extent attributable to space-borne observations and their assimilation in numerical models.

## 2.1 Space-based Observations

Space-borne passive sensing for meteorological applications is performed in bands allocated to the Earth exploration-satellite (passive) and meteorological-satellite services. Passive sensing requires the measurement of naturally occurring radiation, usually of very low power levels, which contains essential information on the physical process under investigation.

The relevant frequency bands are determined by fixed physical properties (molecular resonance) that cannot hence be changed or ignored, nor are these physical properties able to be duplicated in other bands. Therefore, these frequency bands are an important natural resource. Even low levels of interference received by a passive sensor may degrade its data. In addition, in most cases these sensors are not able to discriminate between natural and man-made radiation.

For passive sensing bands shared with active services, the situation is becoming increasingly critical with an increased density of terrestrial active devices and serious cases of interference already being reported.

In the more critical passive sensing frequency bands, RR No. **5.340**<sup>3</sup> stating that "all emissions are prohibited" enables in principle passive services to deploy and operate their systems with the highest reliability. However, in some cases this protection appears to be insufficient due to unregulated and potentially mass-market short-range devices allowed nationally to operate in these bands or unwanted emissions from not properly regulated adjacent bands. One example is the significant interference in the passive band 1 400-1 427 MHz being observed worldwide by the radiometers on the Soil Moisture and Ocean Salinity (SMOS) and Aquarius satellites.

Several geophysical parameters contribute, at varying levels, to natural emissions, which can be observed at a given frequency which presents unique properties. Therefore, measurements at several frequencies in the microwave spectrum must be made simultaneously in order to isolate and

<sup>3</sup> Footnote No. **5.340** of the Table of Frequency Allocations in the international Radio Regulations.

to retrieve each individual contribution, and to extract the parameters of interest from the given set of measurements.

Consequently, interference that could impact a given “passive” frequency band could thus have an impact on the overall measurement of a given atmospheric component.

Each passive frequency band cannot hence be considered on its own but should be seen as a complementary component of a complete space-borne passive sensing system. Current scientific and meteorological-satellite payloads are not dedicated to one given band but include many different instruments performing measurements in the entire set of passive bands.

It should also be noted that full global data coverage is of particular importance for most weather, water and climate applications and services.

Space-borne active sensing, performed by altimeters, rain and cloud radars, scatterometers and Synthetic Aperture Radars<sup>4</sup> provides meteorological and climatology activities with important information on the state of the ocean, ice and land surfaces and atmospheric phenomena.

Also, of great importance is the availability of sufficient and well-protected Earth exploration and meteorological-satellite services radio-frequency spectrum for telemetry/telecommand as well as for satellite downlink of the collected data.

## **2.2 Surface-based and in-situ Observations**

In addition, meteorological radars and wind-profiler radars are important surface-based instruments in the meteorological observation processes. Radar data are input to nowcasting and to the numerical weather prediction models for short-term and medium-term forecasting. There are currently about one hundred wind-profiler radars and several hundreds of meteorological radars worldwide that perform precipitation and wind measurements and play a crucial role in the immediate meteorological and hydrological alert processes. Meteorological radar networks represent the last line of defence in a disaster warning strategy against loss of life and property in flash flood or severe storm events, such as in several recent dramatic cases.

Meteorological aids systems, mainly radiosondes, are the main source of atmospheric in situ measurements with high vertical resolution (temperature, relative humidity and wind speed) to provide real time vertical atmospheric profiles that are and will remain essential for operational meteorology, including weather analysis prediction and warnings, as well as for climate monitoring. In addition, these in situ

<sup>4</sup> Synthetic Aperture Radars (SAR) provide complementary information, which is useful for flood disaster management and many other applications.

measurements are essential for calibrating space-borne remote sensing, in particular passive sensors.

The Eighteenth World Meteorological Congress (Geneva, June 2019), attended by 193 Member countries, confirmed serious concern at the continuous threat to radio frequency bands allocated for meteorological and related environmental systems and adopted the Resolution 42 (Cg-XVIII) – Radio frequencies for meteorological and related environmental activities – in which all WMO Member countries are urged to make all efforts to do their utmost to ensure the availability and protection of suitable radio frequency bands required for meteorological and related environmental operations and research.

### **2.3 WMO Actions**

The Eighteenth World Meteorological Congress (Geneva, June 2019) "...stresses that some radio-frequency bands are a unique natural resource due to their special characteristics and natural radiation enabling spaceborne passive sensing of the atmosphere and the Earth's surface, which deserve adequate allocation to the Earth exploration satellite service (passive) and absolute protection from interference", and "...expresses its serious concern at the continuing threat to several radio-frequency bands allocated to the meteorological aids, meteorological-satellite, Earth-exploration satellite and radiolocation (weather and wind profiler radars) services posed by the development of other radiocommunication services."

The dependency of observing systems on radio-frequency management has long-term ramifications on the sustainability and usability of essential climate variables and other weather, water and climate related observations that contribute to the Observations and Monitoring pillar of the Global Framework for Climate Services (GFCS) as identified at the Eighteenth World Meteorological Congress (Geneva, June 2019).

## **3 WMO PRELIMINARY POSITION ON WRC-23 AGENDA ITEMS**

Among WRC-23 agenda items, 17 items or topics are related to frequency bands or issues of prime interest or concern for meteorology and related fields:

Agenda item 1.2: Identification of bands, including possible mobile service allocations, for International Mobile Telecommunications (IMT)

Agenda item 1.3: Primary allocation of the band 3 600-3 800 MHz to the mobile service within Region 1

- Agenda item 1.4: High-altitude platform stations as IMT base stations (HIBS) in frequency bands below 2.7 GHz
- Agenda item 1.6: Regulatory provisions to facilitate radiocommunications for sub-orbital vehicles
- Agenda Item 1.10: Possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications in 15.4-15.7 GHz and 22-22.21 GHz
- Agenda item 1.12: Possible new secondary allocation to the Earth exploration-satellite service (active) around 45 MHz
- Agenda item 1.13: Upgrade of the space research service allocation to primary in the frequency band 14.8-15.35 GHz
- Agenda item 1.14: Possible adjustments of the existing or possible new allocation to the EESS (passive) in 231.5-252 GHz
- Agenda item 1.16: Use of the frequency bands 17.7-18.6 GHz (s-E), 18.8-19.3 GHz (s-E), 19.7-20.2 GHz (s-E), 27.5-29.1 GHz (E-s) and 29.5-30 GHz (E-s) by earth stations in motion (ESIMs)
- Agenda item 1.17: Regulatory actions for the provision of intersatellite links in specific frequency bands
- Agenda Item 1.18: Potential new allocations to the MSS in the frequency bands 1695-1710 MHz, 2010-2025 MHz, 3300-3316 MHz and 3385-3400 MHz for future narrowband MSS systems
- Agenda item 7: Satellite regulatory procedures
- Agenda item 9.1a): Appropriate recognition and protection in the Radio Regulations for space weather sensors, without placing additional constraints on incumbent services
- Agenda item 9.1b): Amateur service and amateur-satellite service allocations in 1 240-1 300 MHz
- Agenda item 9.1c): Study use of IMT for fixed wireless access in bands allocated to the fixed service
- Agenda item 9.1d): Protection of EESS (passive) in the frequency band 36-37 GHz from non-GSO FSS space stations
- Agenda item 10: Preliminary agenda for WRC-27

### **3.1 Agenda item 1.2**

*"to consider identification of the frequency bands 3 300-3 400 MHz, 3 600 3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible*

*additional allocations to the mobile service on a primary basis, in accordance with Resolution **245 (WRC 19)***”

Footnote **No 5.458** indicates that Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz as passive microwave sensor measurements are carried out in these frequency bands. The WMO OSCAR database<sup>5</sup> lists some existing and planned satellite missions that include operation of a passive sensor in these bands.

Similarly, the WMO OSCAR database lists numerous existing and planned satellite missions that include operation of a passive sensor in the 10.6-10.7 GHz frequency range WMO recognizes that a 100 MHz guard-band exists between the EESS (passive) frequency band and the 10.0-10.5 GHz frequency band proposed for IMT but stresses the fact that IMT studies in other frequency bands have shown that guard-bands alone do not necessary, ensure protection of the EESS (passive).

In addition, the potential identification of the 10.0-10.5 GHz band for IMT could result in interference to EESS (active) at 10-10.4 GHz.

The abovementioned potential interference issues require study in the ITU-R under this agenda item.

The possible impact on the FSS (space to Earth) and the use of commercial of communication satellites for the distribution of meteorological data above 3.8 GHz could also be a concern.

Working Party 5D is the responsible group for studies with Working Party 7C contributing to the studies with regard to the EESS (passive) and EESS (active).

### **WMO Position on WRC-23 agenda item 1.2**

WMO is concerned regarding:

- the protection of EESS (passive) and SRS (passive) in the 6 425-7 075 MHz and 7 075-7 250 MHz frequency bands,
- the protection of EESS (passive) and SRS (passive) in the 10.6-10.7 GHz frequency band from unwanted emissions from IMT, operating within the 10.0-10.5 GHz band. WMO supports studies to determine the necessary limits to protect passive sensing operations in 10.6-10.7 GHz.
- the protection of EESS (active) in the band 10-10.4 GHz,
- the possible impact on future usage of the band 3.8-4.2 GHz used for the distribution of meteorological data.

<sup>5</sup> See <http://oscar.wmo.int/space>.



### 3.2 Agenda item 1.3

*"to consider primary allocation of the band 3 600-3 800 MHz to mobile service within Region 1 and take appropriate regulatory actions, in accordance with Resolution 246 (WRC-19)"*

The possible impact on the FSS (space to Earth) and the use of commercial of communication satellites for the distribution of meteorological data above 3.8 GHz could be a concern.

#### **WMO Position on WRC-23 agenda item 1.3**

WMO is concerned regarding the possible impact on future usage of the band 3.8-4.2 GHz used for the distribution of meteorological data.

### 3.3 Agenda item 1.4

*"to consider, in accordance with Resolution **247 (WRC 19)**, the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level"*

Operational experience of at least one WMO Member shows that ground-based broadband wireless base stations operating below 2690 MHz can cause interference to meteorological radars operating above 2700 MHz. The interference was due to unwanted emissions falling into the radar band and not due to the radar receiver selectivity extending into the broadband wireless band. Interference mitigation could only be achieved through reducing the broadband wireless base station out-of-band emissions. This WRC-23 agenda item considers operation of broadband wireless base stations on airborne platforms, which will place a potential source of unwanted emissions in and near the radar antenna main beam, increasing the antenna gain in the interference path by as much as 35 dB relative to the above-mentioned real interference cases.

Additionally, directly adjacent to one of the proposed bands is the 2690-2700 MHz in which EESS (passive) allocation subject to 5.340 and the use or future use of this frequency band will need to be assessed.

Finally, studies carried out in Europe (ECC Report 309) conclude that interference can occur in the MetSat allocation in the adjacent band (1675-1710 MHz) if the band 1710-1855 MHz, already identified for IMT, is used for UAV communications without additional conditions (tighter unwanted emissions limits). Similar potential impact can be expected from HIBS and protection of MetSat service in the 1675-1710 MHz band needs then to be ensured.

Working Party 5D is the responsible group for conducting studies, with Working Party 5B contributing to the studies with regard to meteorological radar, Working Party 7C contributing to the studies with regard to EESS

(passive) and Working Party 7B contributing to the studies with regard to MetSat service.

#### **WMO Position on WRC-23 agenda item 1.4**

WMO is of the opinion that studies must be conducted to specify the HIBS out-of-band unwanted emissions to prevent interference:

- to meteorological radars in the 2700-2900 MHz band from HIBS operated in the 2500-2690 MHz band,
- to MetSat service in the 1675-1710 MHz from HIBS operated in the 1710-1885 MHz band.

### **3.4 Agenda item 1.6**

*"to consider, in accordance with Resolution **772 (WRC 19)**, regulatory provisions to facilitate radiocommunications for sub-orbital vehicles"*

This agenda item addresses spectrum needs for sub-orbital vehicles that operate in both the aeronautical and space domains, with communications requirements spanning both aviation and satellite operations. While this agenda item does not permit changes to Article 5 of the Radio Regulations (no changes to frequency allocations), other regulatory changes permitted under this agenda item could affect regulatory provisions that are applicable to the meteorological satellite (MetSat) and Earth exploration-satellite services (EESS) and could increase congestion in the corresponding frequency bands.

It should be noted that sub-orbital vehicle technology may have the potential to support missions of interest to WMO in the future.

Working Party 5B is the responsible group for studies, with Working Party 7B contributing to the studies with regard to MetSat and EESS systems.

#### **WMO Position on WRC-23 agenda item 1.6**

WMO supports studies on the development of regulatory provisions to meet the requirements of sub-orbital vehicle operations but would be opposed to provisions that have a negative impact to current and future MetSat and EESS operations.

### **3.5 Agenda item 1.10**

*"to conduct studies on spectrum needs, coexistence with radiocommunication services and regulatory measures for possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications, in accordance with Resolution **430 (WRC-19)**;"*

This agenda item considers allocation changes to allow non-safety aeronautical mobile operations for air-to-air, air-to-ground and ground-to-air communications. The frequency band 15.4-15.7 GHz is under consideration for a new aeronautical mobile allocation whereas removal of the "except aeronautical mobile" restriction is being considered for the 22-22.21 GHz frequency band.

The 22-22.21 GHz frequency band under consideration is adjacent to the band 22.21-22.5 GHz allocated to the EESS (passive).

It has also to be noted that the 15.4-15.7 GHz frequency band is adjacent to the band 15.35-15.4 GHz (footnote RR **No 5.340**) where the use or future use of this frequency band will be assessed.

Adjacent band studies are required to ensure protection of these EESS (passive) frequency bands.

Working Party 5B is the responsible group for studies, with Working Party 7C contributing to the studies with regard to EESS (passive) systems.

**WMO Position on WRC-23 agenda item 1.10**

WMO supports studies to ensure protection of the EESS (passive) in the adjacent frequency band 22.21-22.5 GHz and possibly the 15.35-15.4 GHz band when its usage will have been assessed.

**3.6 Agenda item 1.12**

*"to conduct, and complete in time for WRC 23, studies for a possible new secondary allocation to the Earth exploration-satellite (active) service for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution **656 (Rev. WRC 19)**"*

This agenda was originally developed and placed on the WRC-23 Preliminary Agenda by WRC-15. WRC-19 reviewed the status of the work and retained the item on the final WRC-23 agenda to consider a secondary allocation to the EESS (active) around 45 MHz.

This agenda item is of interest to WMO to, on the one hand, ensure protection of oceanographic radars operating in 41.015-42 MHz and 42.5-44 MHz under **RR 5.161A** and, on the other hand, consider a future use of this EESS (active) allocations for meteorological/climate purposes.

Working Party 7C is the responsible group for studies, with Working Party 5B contributing to the studies with regard to oceanographic radars.

**WMO Position on WRC-23 agenda item 1.12**

WMO supports completion of studies to ensure compatibility of incumbent radio services with a view of creating secondary allocation to the EESS (active) at WRC-23.

### 3.7 Agenda item 1.13

*"to consider a possible upgrade of the allocation of the frequency band 14.8-15.35 GHz to the space research service, in accordance with Resolution **661 (WRC 19)**"*

Agenda Item 1.13 calls for consideration of upgrading the existing space research service (SRS) secondary allocation in 14.8-15.35 GHz to primary status. A primary allocation to the EESS (passive) exists in the adjacent band 15.35-15.4 GHz but its use or future use in this frequency band will be assessed. According to the results of this future assessment, compatibility studies may be required to ensure unwanted emissions from future SRS systems do not impact the EESS (passive) service in the adjacent frequency band.

Working Party 7B is the responsible group for studies, with Working Party 7C contributing to the studies with regard to EESS (passive).

#### **WMO Position on WRC-23 agenda item 1.13**

WMO is not opposed to the upgrading the existing space research service (SRS) secondary allocation in 14.8-15.35 GHz to primary status. Compatibility studies may be required with EESS (passive) when its usage will have been assessed in the 15.35-15.4 GHz frequency band.

### 3.8 Agenda item 1.14

*"to review and consider possible adjustments of the existing or possible new primary frequency allocations to EESS (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution **662 (WRC 19)**"*

This WRC-23 Agenda item was initiated by MetSat operators with the goal of better aligning or adding possible new allocations to the EESS (passive) in the 231.5-252 GHz frequency range with passive sensor design requirements. The allocations to the EESS (passive) were created 20 years ago at a time when operational requirements were unclear. Realigning the allocations will result in better protection of future MetSat operations within the 231.5-252 GHz frequency range.

Working Party 7C is the responsible group for conducting studies.

#### **WMO Position on WRC-23 agenda item 1.14**

WMO supports conducting studies to align or adding possible new allocations to the EESS (passive) in 231.5-252 GHz with current operational requirements.

### 3.9 Agenda item 1.16

*"to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-GSO FSS earth stations in motion, while ensuring due protection of existing services in those frequency bands, in accordance with Resolution **173 (WRC 19)**"*

This agenda item calls for the study and development of technical, operational and regulatory measures to facilitate use of several frequency bands by non-GSO fixed satellite service (FSS) earth stations in motion (ESIMs). This agenda item includes consideration of frequency bands for ESIM operation adjacent to the 18.6-18.8 GHz frequency band used for passive sensing, as well as potential ESIM operation in the 28.5-30 GHz where a secondary allocation to the EESS exists for transmission of data.

The frequency band 17.7-18.6 GHz is also overlapping with GSO MetSat allocation 18-18.3 GHz (ITU Region 2) and 18.1-18.4 GHz (ITU Regions 1 and 3) in accordance with footnote RR **No 5.519**.

With regard to the frequency band 18.6-18.8 GHz, it is unclear if changes to the FSS (space-to-Earth direction) are planned to support ESIM operations and whether those potential changes may potentially have an impact to the EESS (passive). The work on this issue must be followed to determine if in-depth studies are required to ensure the protection of the EESS (passive).

It should be noted that ITU-R Working Party 7C is currently addressing existing interference received by EESS (passive) sensors in the 18.6-18.8 GHz band.

With regard to ESIMS operation in the 28.5-30 GHz frequency range, Resolution 173 states that no additional constraints should be imposed on the EESS. However, the EESS allocation is secondary whereas the FSS allocation is primary. It is unclear at this stage how the no constraints to the EESS can be ensured without contravening a basic principle of the Radio Regulations.

Working Party 4A is the responsible group for studies, with Working Party 7B contributing with regard to the EESS in 28.5-30 GHz. Working Party 7C is not listed but should also be a contributing working group with regard to EESS (passive) in 18.6-18.8 GHz.

#### **WMO Position on WRC-23 agenda item 1.16**

WMO supports studies to ensure non-GSO FSS ESIM deployment will ensure the protection of co-frequency band MetSat allocation and that in the frequency bands adjacent to 18.6-18.8 GHz will not result in increased adjacent band interference to EESS (passive) operations.

### 3.10 Agenda item 1.17

*"to determine and carry out, on the basis of the ITU R studies in accordance with Resolution **773 (WRC 19)**, the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate"*

This agenda item calls for studies on provisions to allow satellite-to-satellite links to be operated in several frequency bands allocated to the FSS (e.g. 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz).

The frequency band 18.1-18.6 GHz is overlapping with GSO MetSat allocation 18-18.3 GHz (ITU Region 2) and 18.1-18.4 GHz (ITU Regions 1 and 3) in accordance with footnote RR **No 5.519**.

Use of the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz would place the satellite-to-satellite operations adjacent to the 18.6-18.8 GHz frequency band, which is allocated to the EESS (passive). While provisions were established at WRC-2000 and WRC-2003 to address compatibility between the FSS and EESS (passive) in the band 18.6-18.8 GHz, the basis of the provisions did not take into account satellite-to-satellite links. Studies must be conducted to ensure the proposed new satellite links will not result in increased interference to the EESS (passive).

It should be noted that ITU-R Working Party 7C is currently addressing existing interference received by EESS (passive) sensors in the 18.6-18.8 GHz band.

The frequency band 27.5-30 GHz is partly overlapping with secondary EESS (Earth-to-space) 28.5-30 GHz in accordance with footnote RR **No 5.541**. It is unclear at this stage whether protecting this secondary allocation needs to be addressed.

Working Party 4A is the responsible group for studies. Working Party 7C is not listed but should also be a contributing working group with regard to EESS (passive) in 18.6-18.8 GHz.

#### **WMO Position on WRC-23 agenda item 1.17**

WMO supports studies to ensure FSS satellite-to-satellite links will ensure the protection of co-frequency band MetSat allocation and that in the frequency bands adjacent to 18.6-18.8 GHz will not result in increased adjacent band interference to EESS (passive) operations.

To this respect, WMO is of the opinion that Working Party 7C should be listed as a contributing group under Agenda Item 1.17.

### 3.11 Agenda item 1.18

*"to consider studies relating to spectrum needs and potential new allocations to the mobile-satellite service for future development of narrowband mobile-satellite systems, in accordance with Resolution **248 (WRC 19)**"*

This agenda item initiates studies for consideration of new allocations to the mobile satellite service in several frequency bands, including consideration of the frequency band 1695-1710 MHz (in Region 2 only). The frequency band 1695-1710 MHz is allocated to the MetSat service and is primarily used for non-GSO MetSat data downlinks to earth stations around the world.

The protection of the EESS (Earth-to-space and space-to-space) and Space Research (Earth-to-space and space-to-space) in adjacent band 2025-2110 MHz also needs to be ensured.

Working Party 4C is the responsible group for studies, with Working Party 7B contributing with regard to the MetSat service.

#### **WMO Position on WRC-23 agenda item 1.18**

WMO supports compatibility studies to ensure protection of current and future MetSat operations in the band 1695-1710 MHz as well as the operations of EESS (Earth-to-space and space-to-space) and Space Research (Earth-to-space and space-to-space) in the adjacent band 2025-2110 MHz.

### 3.12 Agenda item 7

*"to consider possible changes, and other options, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, an advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution **86 (Rev. WRC 07)**, in order to facilitate rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary satellite orbit."*

This standing agenda item deals with any possible changes to the Radio Regulations affecting the advance publication, coordination, notification and recording of satellite networks and requires WMO consideration.

Working Party 4A is the responsible group for conducting studies.

#### **WMO Position on WRC-23 agenda item 7**

WMO does not support changes to the Radio Regulations that would impose unnecessary constraints on MetSat and EESS systems. WMO will follow the development of Agenda Item 7 issues as they are identified and studied.

### 3.13 Agenda item 9.1, Topic a

*"In accordance with Resolution 657 (Rev. WRC 19), review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services"*

Work began in the ITU-R and WMO in 2014 to determine the radio spectrum requirements for space weather sensors that use the radio spectrum for acquiring data. WRC-2015 placed an item on the Preliminary Agenda of WRC-23 calling for regulatory changes to provide protection to space weather sensors that use radio spectrum. WRC-19 reviewed the work on the topic and included the issue on the WRC-23 agenda as a Topic under Agenda item 9.1, and placed a subsequent item of the Preliminary Agenda for WRC-27 to resolve any remaining regulatory issues.

Space weather sensors that use the radio spectrum currently do not have any regulatory protection in the radio regulations. It is of vital importance to WMO members that this effort be completed to ensure protection of sensor operations in the future.

Under WRC-23 Agenda item 9.1 Topic a), the following issues need to be completed for consideration by WRC-23:

- Determine the appropriate radiocommunication service or services that these sensors should fall under.
- Conduct sharing studies with incumbent systems operating in frequency bands used by space weather sensors with the objective of determining potential regulatory provisions that can be provided to receive-only operational space weather sensors for their appropriate recognition in the Radio Regulations, while not placing additional constraints on incumbent services.
- Develop potential solutions to describe in the Radio Regulations, Articles 1 and 4, and/or as a WRC resolution, if deemed appropriate space weather sensor systems and their corresponding usage, as well as protection requirements for receive-only space weather sensors

Working Party 7C is the responsible group for conducting studies.

#### **WMO Position on WRC-23 agenda item 9.1 Topic a)**

WMO supports ensuring the protection of space weather sensors that use radio spectrum and will contribute to the corresponding studies.



### 3.14 Agenda item 9.1. Topic b

*"Studies on technical and operational measures to be applied in the frequency band 1 240-1 300 MHz to ensure the protection of the radionavigation-satellite service (space-to-Earth);"*

Topic b) under Agenda Item 9.1 calls for studies on technical and operational measures to be applied in the frequency band 1 240-1 300 MHz to ensure the protection of the radionavigation-satellite service (space-to-Earth).

Wind profiler radars are operating in the band 1270-1295 MHz in accordance with Resolution 217 (WRC-97).

Working Parties 4C and 5A are jointly responsible for conducting studies.

#### **WMO Position on WRC-23 agenda item 9.1 Topic b)**

WMO will monitor and, if necessary, contribute to the work on this Topic to ensure that wind profiler radar will not be affected.

### 3.15 Agenda item 9.1. Topic c

*"Study the use of International Mobile Telecommunication system for fixed wireless broadband in the frequency bands allocated to the fixed services on primary basis, in accordance with Resolution **175 (WRC 19)**;"*

Topic c) under Agenda Item 9.1 calls for studies on the use of existing frequency bands allocated to the fixed service. As an issue under Agenda item 9.1 no regulatory changes can be made but other changes to the Radio Regulations may be accomplished. This item is of concern since any frequency band allocated to the fixed service is open for consideration and has hence the potential to change coexistence conditions for services allocated in-band or adjacent to frequency bands allocated to the fixed service.

This agenda item could then affect a number of meteorological applications including EESS, MetSat and MetAids frequency bands either in-band or adjacent frequency bands. It needs to be stressed that this also includes a number of EESS (passive) bands in which footnote RR **No 5.340** applies.

Working Parties 5A and 5C are jointly responsible for conducting studies with Working Parties 7B and 7C contributing.

**WMO Position on WRC-19 agenda item 9.1 Topic c)**

WMO is concerned about this Topic c) under Agenda item 9.1 that is very broad in scope and could hence potentially affect a large number of meteorological operations and applications, including EESS (passive) under RR **No 5.340**.

WMO will monitor the work on this Topic and contribute as necessary.

**3.16 Agenda item 9.1. Topic d**

*"Protection of EESS (passive) in the frequency band 36-37 GHz from non-GSO FSS space stations;"*

Under studies considered for WRC 19 Agenda item 1.6, a preliminary study on the protection of EESS (passive) sensors operating in the band 36-37 GHz from non-GSO FSS space stations in the band 37.5-38 GHz was submitted to the ITU-R. This preliminary study indicated that it may be necessary to apply to FSS non-GSO space stations an unwanted e.i.r.p of –34 dBW/100 MHz, for all angles greater than 71.4 degrees from nadir. In addition, interference into the cold calibration channel of the EESS (passive) sensor operating in the frequency band 36-37 GHz was not studied.

On this basis, WRC 19 invited ITU-R to conduct further study of this topic and develop Recommendations and/or Reports, as appropriate, and report back to WRC 23 to take action, if necessary. Furthermore, WRC 19 agreed that modifications to Resolution 750 (Rev WRC-19) should not be considered under these studies since the frequency band 36-37 GHz is not referenced in No. 5.340.

Working Party 7C is the responsible group for conducting studies.

**WMO Position on WRC-23 agenda item 9.1 Topic d)**

WMO supports studies to further evaluate the impact of non-GSO FSS operations in the band 37.5-38 GHz on EESS (passive) sensors in the band 36-37 GHz, in particular the interference impact on the cold-sky calibration of passive sensors.

**3.17 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)**)."*

WRC-19 established the Preliminary Agenda for WRC-27. The preliminary agenda will be reconsidered at WRC-23 where each preliminary agenda item will be evaluated for inclusion in the final WRC-27 agenda.

The current WRC-27 preliminary agenda has a number of items of interest and/or concern to WMO:

- **Preliminary Agenda item 2.1-** to consider, in accordance with Resolution **663 (WRC-19)**, additional spectrum allocations to the radiolocation service on a co-primary basis in the frequency band 231.5-275 GHz and identification for radiolocation applications in frequency bands in the range 275-700 GHz for millimetre and sub-millimetre wave imaging systems;

The frequency ranges specified in this agenda item overlap some frequency bands allocated to, or identify for use by, the EESS (passive). Protection of the EESS (passive) must be ensured.

- **Preliminary Agenda item 2.2-** study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) by aeronautical and maritime earth stations in motion communicating with geostationary space stations in the fixed-satellite service, in accordance with Resolution **176 (WRC 19)**;

This preliminary agenda item considers regulatory provisions to facilitate deployment of earth stations in motion (ESIMs) operating in the fixed satellite service. This preliminary agenda item introduces a potential for increased interference to the EESS (passive) in the 50.2-50.4 GHz frequency band.

- **Preliminary Agenda Item 2.5-** the conditions for the use of the 71-76 GHz and 81-86 GHz frequency bands by stations in the satellite services to ensure compatibility with passive services in accordance with Resolution **776 (WRC 19)**;

This preliminary agenda item calls for studies of regulatory provisions that could be implemented to ensure protection of passive services including the EESS (passive) in the frequency band 86-92 GHz, from satellite operations in 71-76 GHz and 81-86 GHz. The protection of the EESS (passive) in 86-92 GHz through implementation of mandatory limits in Resolution **750 (WRC-19)** is a priority for WMO.

- **Preliminary Agenda item 2.6-** to consider regulatory provisions for appropriate recognition of space weather sensors and their protection in the Radio Regulations, taking into account the results of ITU R studies reported to WRC 23 under agenda item 9.1 and its corresponding Resolution **657 (Rev. WRC 19)**;

This preliminary agenda item is intended as a follow-on to WRC-23 Agenda Item 9.1, Topic A. Under Agenda Item Topic A, regulatory changes are not permitted. This follow-on preliminary agenda item for WRC-27 will address any required regulatory changes.

- **Preliminary Agenda item 2.7-** to consider the development of regulatory provisions for non-geostationary fixed-satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and proposed new Earth-to-space) and 81-86 GHz (Earth-to-space), in accordance with Resolution **178 (WRC 19)**;

This preliminary agenda item is related to the same topic covered under Preliminary Agenda item 2.5. This agenda item calls for studies to address the protection of the EESS (passive) in the 86-92 GHz frequency band. The protection of the EESS (passive) in 86-92 GHz through implementation of mandatory limits in Resolution **750 (WRC-19)** is a priority for WMO. From a WMO perspective, either Preliminary Agenda item 2.5 or this agenda item should be retained, but both are not needed to address WMO concerns.

- **Preliminary Agenda item 2.11-** to consider a new EESS (Earth-to-space) allocation in the frequency band 22.55-23.15 GHz, in accordance with Resolution **664 (WRC 19)**;

This preliminary agenda item calls for consideration of creating a new EESS (earth-to-space) allocation in the frequency band 22.55-23.15 GHz frequency band to be paired with the existing 25.5-27 GHz (space-to-Earth) EESS frequency allocation. The creation of the new allocation to the EESS would benefit WMO interests.

- **Preliminary Agenda item 2.13-** to consider a possible worldwide allocation to the mobile satellite service for the future development of narrowband mobile-satellite systems in frequency bands between the range 1.5-5 GHz, in accordance with Resolution **248 (WRC-19)**,

This preliminary agenda item appears to be a duplicate of Agenda item 1.18 on the WRC-23 agenda. The reason for inclusion on the WRC-27 preliminary agenda is unclear.

See WRC-23 Agenda item 1.18 for discussion and WMO position.

#### **WMO Position on WRC-23 agenda item 10**

WMO supports studies on the WRC-27 preliminary agenda items to ensure meteorological interests are protected. If work in the ITU-R is conducted on any of the WRC-27 Preliminary agenda items during the preparatory period for WRC-23 WMO will contribute to ensure WMO interests are protected.