

## **World Meteorological Organization**

### **WMO PRELIMINARY POSITION ON WRC-15 AGENDA\***

#### **1 Introduction**

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 (NMHS) 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 organisations, 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, detection and mitigating 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 WMO Integrated Global Observing System.

WMO information systems also make extensive use of radiocommunication systems and radio-frequency spectrum, and although they are also using commercially provided services such as communication satellites, 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.

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\* This document was developed and approved at the meeting of the WMO Steering Group on Radio-Frequency Coordination (SG-RFC) on 17-19 November 2014 before CPM15-2. It is based on the Draft CPM Report to WRC-15 and it will be reviewed in September 2015 taking into account REPORT OF CPM on operational and regulatory/procedural matters to THE WORLD RADIOCOMMUNICATION CONFERENCE 2015. Text is available in the other five languages at <http://www.itu.int/md/meetingdoc.asp?lang=en&parent=R12-CPM15.02-C-0003>

The Report 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 losses of lives or threats to socio-political stability and security. 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 added-value 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 radio-frequencies 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>†</sup>.

This document reflects the preliminary position of the World Meteorological Organisation (WMO) on the agenda of the World Radiocommunication Conference 2015 (WRC-15) as given in Resolution **807 (WRC-12)** “Agenda for the 2015 World Radiocommunication Conference”, subsequently approved by the ITU Council 2012 in its Resolution 1343.

## 2 General comments

The WMO Integrated Global Observing System (WIGOS) comprises components which make use of a wide number of different radio applications and services, some of which may be affected by WRC-15 Decisions.

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 and climate-related disasters, and in the scientific understanding, monitoring and prediction of climate change and its impacts.

The impressive progress made in the recent years in weather 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.

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 radiations, usually of very low power levels, which contain essential information on the physical process under investigation.

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<sup>†</sup> GEO has the objective to realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information. GEO focuses on nine Social Benefits Areas: Agriculture, Biodiversity, Climate, Disasters, Ecosystems, Energy, Health, Water and Weather. GEO strongly advocates full and open data sharing to ensure that all countries benefit from data and information mostly at no cost to users. 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.

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 radiations.

For passive sensing bands shared with active services, the situation is tending to be more and more critical with the 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** 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 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 to retrieve each individual contribution, and to extract the parameters of interest from the given set of measurements.

As a consequence, 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 in particular by altimeters, rain and cloud radars, scatterometers and Synthetic Aperture Radars‡ provides meteorological and climatology activities with important information on the state of the ocean, ice and land surfaces and atmospheric phenomena.

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)

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‡ Synthetic Aperture Radars (SAR) provide complementary information useful for flood disaster management.

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

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.

Finally, it should be noted that the fixed-satellite service systems, through commercial payloads in the C-band (3 400-4 200 MHz) and the Ku-band (10 700-11 700 MHz), are used globally to disseminate weather, water and climate related information, including disaster warnings to meteorological agencies and user communities. It has to be stressed that a large part of the population, in particular in developing countries, is heavily dependent on the use of C-band satellites in areas where propagation conditions (e.g. heavy rain in tropical and equatorial zones) make the use of any other telecommunication support impractical.

The Fifteenth World Meteorological Congress (Geneva, May 2007), attended by 163 Member countries, confirmed serious concern at the continuous threat to radio frequency bands allocated for meteorological and related environmental systems and adopted the Resolution 4 (Cg-XV) – *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.

The Sixteen World Meteorological Congress (Geneva, May 2011) “... agreed that the protection of frequencies used for meteorological purposes is of direct and vital interest to the international meteorological community and reiterated its full support for radio-frequency activities. It urged the pursuance of, in an organized manner, the continuous review of regulatory and technical matters related to radio-frequencies for operational and research meteorological and related environmental activities.”

The WMO Integrated Global Observing System (WIGOS) comprises components which make use of a wide number of different radio applications and services, some of which may be affected by WRC-15 Decisions. 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 World Meteorological Congress XVI in 2011, and the Extraordinary World Meteorological Congress in 2012.

### **3 WMO preliminary position on WRC-15 agenda**

Among WRC-15 agenda items, eleven items are related to frequency bands or issues of prime interest or concern for meteorology and the related fields.

There are also seven WRC-15 agenda items that are currently not involving specific frequency bands used for meteorological purposes and the related fields but may potentially have an impact on WMO interests, either due to their wide open scope in terms of frequency ranges under study or in relation with a potential general interest.

The WRC-15 Decisions on the following WRC-15 agenda items may have positive or negative effect on development and operation of meteorological systems and applications:

**Agenda item 1.1**

additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) (see section 3.1);

**Agenda item 1.6**

consider possible additional primary allocations to the fixed-satellite service (FSS) of 250 MHz (in Regions 1<sup>§</sup> and 2) and 300 MHz (in Region 3) (see section 3.2);

**Agenda item 1.9.2**

consider the possibility of allocating the bands 7 375-7 750 MHz and 8 025-8 400 MHz to the maritime-mobile-satellite service (see section 3.3);

**Agenda item 1.10**

consider spectrum requirements and possible additional spectrum allocations for the mobile-satellite service in the Earth-to-space and space-to-Earth directions, including the satellite component for broadband applications (see section 3.4);

**Agenda item 1.11**

consider a primary allocation for the Earth exploration-satellite service (Earth-to-space) in the 7-8 GHz range (see section 3.5);

**Agenda item 1.12**

consider an extension of the current worldwide allocation to the Earth exploration-satellite (active) service in the frequency band 9 300-9 900 MHz by up to 600 MHz within the frequency bands 8 700-9 300 MHz and/or 9 900-10 500 MHz (see section 3.6);

**Agenda item 1.17**

consider possible spectrum requirements and regulatory actions, including appropriate aeronautical allocations, to support wireless avionics intra-communications (WAIC) (see section 3.7);

**Agenda item 9.1, Issue 9.1.1**

consider and approve the Report of the Director on the ITU-R activities on protection of the systems operating in the mobile-satellite service in the band 406-406.1 MHz (see section 3.8);

**Agenda item 9.1, Issue 9.1.5**

consider and approve the Report of the Director on the ITU-R activities on technical and regulatory actions in order to support existing and future operation of fixed-satellite service earth stations within the band 3 400-4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1 (see section 3.9);

**Agenda item 9.1, Issue 9.1.8**

consider and approve the Report of the Director on the ITU-R activities on regulatory aspects for nano- and picosatellites (see section 3.10);

**Agenda item 10**

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<sup>§</sup> Here and after whenever Regions 1, 2 or 3 are mentioned they are ITU-R Regions as specified in Article 5 of the Radio Regulations.

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 (see section 3.11).

**Other WRC-15 agenda items that may potentially have an impact on WMO interests are the following (see section 3.12):**

**Agenda item 1.3**

review and revise Resolution **646 (Rev.WRC-12)** for broadband public protection and disaster relief (PPDR);

**Agenda item 1.5**

consider the use of frequency bands allocated to the fixed-satellite service for the control and non-payload communications of unmanned aircraft systems (UAS);

**Agenda item 1.9.1**

consider possible new allocations to the fixed-satellite service in the frequency bands 7 150-7 250 MHz (space-to-Earth) and 8 400-8 500 MHz (Earth-to-space);

**Agenda item 1.18**

consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band;

**Agenda item 7**

consider possible changes, and other options, an advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks;

**Agenda item 9.1, Issue 9.1.2**

consider and approve the Report of the Director on the ITU-R activities on studies on possible reduction of the coordination arc and technical criteria used in application of RR No. **9.41** in respect of coordination under RR No. **9.7**;

**Agenda item 9.1, Issue 9.1.6**

studies towards review of the definitions of *fixed service*, *fixed station* and *mobile station*.

**3.1 Agenda item 1.1**

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

Under agenda item 1.1 studies are concentrating on bands between 470 MHz and 6 GHz. Within this frequency range, the frequency bands listed below from the list of the frequency bands studied in ITU-R are of particular interest to WMO.

**3.1.1 The frequency bands 1 350-1 400 MHz and 1 427-1 452 MHz**

WMO interest in the frequency bands 1 350-1 400 MHz and 1 427-1 452 MHz is due to the need for protection of the frequency band 1 400-1 427 MHz\*\*. This band is used for EESS (passive)

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\*\* According to RR No. **5.340** all emissions are prohibited in the frequency band 1 400-1 427 MHz.

sensing by SMOS, SMAP and AQUARIUS and covered by RR No. **5.340**. It needs to be protected from unwanted emissions from possible use by mobile service systems operating in both adjacent bands (1 350-1 400 and 1 427-1 452 MHz) if these frequency bands are allocated and/or identified for IMT.

**WMO position relevant to the frequency bands 1 350-1 400 MHz and 1 427-1 452 MHz:**

WMO does not object to allocation/identification of these frequency bands, as appropriate, under conditions that the relevant mandatory unwanted emission levels for the frequency band 1 400-1 427 MHz, consistent with Report ITU-R RS.[EESS-IMT 1.4 GHz], are included in the Radio Regulations (e.g. in Resolution **750 (Rev.WRC-12)**) to ensure the protection of the EESS (passive) systems (i.e. Methods B and/or C (Option C1a) in draft CPM Report).

**3.1.2 The frequency band 1 695-1 710 MHz**

The frequency band 1 695-1 710 MHz is used by meteorological-satellite systems with earth stations operated by almost all NMHS<sup>††</sup> and many other users. This frequency band is essential for providing operational and time-critical meteorological information to the users around the world. Sharing studies for the frequency band 1 695-1 710 MHz show that the required protection area around MetSat stations from which potential IMT base stations in the frequency band 1 695-1 710 MHz would be up to several hundred kilometres. Therefore, sharing between IMT base stations and MetSat stations in the frequency band 1 695-1 710 MHz is not feasible. Regarding the assessments of protection areas around MetSat stations from which IMT mobile terminals in the frequency band 1 695-1 710 MHz would have to be excluded, sharing studies provide diverging results depending on the assumptions, parameters, and methodologies used. Separation distances are ranging from 32 up to more than 120 km, making the use of this frequency band unpractical for IMT user terminals in most countries without putting MetSat operation at risk.

**WMO position relevant to the frequency band 1 695-1 710 MHz:**

WMO opposes allocation/identification for terrestrial mobile broadband applications including IMT of the frequency band 1 695-1 710 MHz and supports no change to the Radio Regulations (i.e. Method A in draft CPM Report).

**3.1.3 The frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz**

The frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz are used by systems operating in the space research, the Earth exploration-satellite and the space operation services. These bands are essential to all satellite operators and in particular Earth exploration and meteorological-satellite operators. Previous studies showed that the satellite operations are not compatible with high density mobile applications (as confirmed in RR No. **5.391** and Recommendation ITU-R SA.1154) and new ITU-R studies, described in Report ITU-R SA.[EESS-IMT 2 025-2 290 MHz], have reaffirmed earlier ITU-R studies as in Recommendation ITU-R SA.1154 resulting in the adoption of RR No. **5.391** at WRC-97, which prohibits high-density mobile systems from operation within these frequency bands.

**WMO position relevant to the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz:**

WMO opposes allocation/identification for terrestrial mobile broadband applications including IMT of the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz.

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<sup>††</sup> NMHS – National Meteorological and Hydrological Services.

### **3.1.4 The frequency band 2 700-2 900 MHz**

The frequency band 2 700-2 900 MHz is used for meteorological radars. This band was already considered for IMT identification (i.e. use by mobile service systems) at WRC-2000 and WRC-07 and was duly rejected. In particular Report ITU-R M.2112 concludes on the non-compatibility between IMT and radars in the 2 700-2 900 MHz frequency band. Based on ITU-R studies, it is concluded that the co-frequency sharing is not possible between IMT and radars unless several hundred kilometres separation distances are imposed.

#### **WMO position relevant to the frequency band 2 700-2 900 MHz:**

WMO opposes allocation/identification for terrestrial mobile broadband applications including IMT of the frequency band 2 700-2 900 MHz and supports no change to the Radio Regulations (i.e. Method A in draft CPM Report).

### **3.1.5 The frequency band 3 400-4 200 MHz**

The frequency band 3 400-4 200 MHz is used by the meteorological community to distribute meteorological data through commercial satellite systems. From the sharing studies it can be concluded that co-frequency sharing between FSS earth stations and IMT-Advanced macro-cell or small-cell outdoor networks would not be feasible in the same geographical area when the FSS earth stations and/or IMT-Advanced stations are deployed in a ubiquitous manner and/or with no individual licensing of earth stations, since no minimum separation can be guaranteed. Conclusion in DN Report ITU-R S.[FSS-IMT C-BAND DOWNLINK] states that “The negative protection ratio indicates that the protection against interference is not sufficient, i.e., the interference potential is considerably high not allowing the co-existence.”

#### **WMO position relevant to the frequency band 3 400-4 200 MHz:**

WMO highlights its requirement to maintain relevant fixed satellite service capacity and availability in the frequency band 3 400-4 200 MHz for dissemination of meteorological data on the global basis.

### **3.1.6 The frequency band 5 350-5 470 MHz**

The frequency band 5 350-5 470 MHz is used by a number of EESS (active) instruments of different type, i.e. altimeters, scatterometers and Synthetic Aperture Radars (SAR). SARs, in particular, were specifically designed to operate solely within these 120 MHz as this frequency band is the only one left in the 5 GHz frequency range where the EESS (active) allocation is not shared with an allocation to the mobile service. Introduction of RLANs to this band would result in severe interference into SARs such as CSAR on Sentinel 1 and RadarSat. Based on the ITU-R study results related to the protection of EESS (active) systems/applications, it is concluded that sharing is not possible even if the RLAN systems are limited to indoor use only. At this stage, no mitigation technique has been determined that would be effective in filling the large negative margins vis-à-vis EESS (active) protection criteria.

The 5 350-5 470 MHz frequency band is also used by ground-based meteorological radars in some countries. Any proposed new allocations would require the protection of all the existing and future radars deployed in the band (Development of any appropriate mitigation techniques to be applied to RLAN and not to meteorological radars).

PDN Report ITU-R RS.[EESS RLAN 5 GHz] states “Results of sharing studies in the annexes show that with the RLAN parameters presented in section 2.2, sharing between RLAN and EESS (active) systems in the 5 350-5 470 MHz range would not be feasible. Sharing may only be feasible if additional RLAN mitigation measures are implemented.”



### **WMO position relevant to the frequency band 5 350-5 470 MHz:**

WMO is highly concerned and opposed to an allocation/identification for RLAN in the frequency band 5 350-5 470 MHz, since it will in particular endanger the operation of current and planned EESS systems. Based on the results of the ITU-R sharing studies and affirming the view that any of the current mitigation techniques proposed so far are impracticable to implement and maintain, WMO concurs with the current ITU-R conclusion that proposes no change to the Radio Regulations (i.e. Method A in draft CPM Report).

### **Summary of WMO position on WRC-15 agenda item 1.1:**

WMO does not object to allocation/identification of the frequency bands 1 350-1 400 MHz and 1 427-1 452 MHz, as appropriate, under conditions that the relevant mandatory unwanted emission levels for the frequency band 1 400-1 427 MHz consistent with Report ITU-R RS.[EESS-IMT 1.4 GHz] are included in the Radio Regulations (e.g. in Resolution **750 (Rev.WRC-12)**) to ensure the protection of the EESS (passive) systems (i.e. Methods B and/or C (Option C1a) in draft CPM Report).

WMO opposes allocation/identification for terrestrial mobile broadband applications including IMT of the frequency band 1 695-1 710 MHz and supports no change to the Radio Regulations (i.e. Method A in draft CPM Report).

WMO opposes allocation/identification for terrestrial mobile broadband applications including IMT of the frequency bands 2 025-2 110 MHz and 2 200-2 290 MHz.

WMO opposes allocation/identification for terrestrial mobile broadband applications including IMT of the frequency band 2 700-2 900 MHz and supports no change to the Radio Regulations (i.e. Method A in draft CPM Report).

WMO highlights its requirement to maintain relevant fixed satellite service capacity and availability in the frequency band 3 400-4 200 MHz.

WMO is also highly concerned and opposed to an allocation/identification for RLAN in the frequency band 5 350-5 470 MHz, since it will in particular endanger the operation of current and planned EESS systems. Based on the results of the ITU-R sharing studies and affirming the view that any of the current mitigation techniques proposed so far are impracticable to implement and maintain, WMO concurs with the current ITU-R conclusion that proposes no change to the Radio Regulations (i.e. Method A in draft CPM Report).

## **3.2 Agenda item 1.6**

*“to consider possible additional primary allocations:”*

### **Agenda item 1.6.1**

*“to the fixed-satellite service (Earth-to-space and space-to-Earth) of 250 MHz in the range between 10 GHz and 17 GHz in Region 1 and review the regulatory provisions on the current allocations to the fixed-satellite service within each range, taking into account the results of ITU-R studies, in accordance with Resolution **151 (WRC-12)**.”*

### **Agenda item 1.6.2**

*“to the fixed-satellite service (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13-17 GHz and review the regulatory provisions on the current allocations to the fixed-satellite service within each range, taking into account the results of ITU-R studies, in accordance with Resolution **152 (WRC-12)**.”*

For WRC-15 agenda items 1.6.1 and 1.6.2, the potentially affected frequency bands of WMO interest are:

- 10.6-10.7 GHz EESS (passive);
- 13.25-13.75 GHz EESS (active).

### **3.2.1 The frequency band 10.6-10.7 GHz**

The frequency band 10.6-10.7 GHz is the primary passive satellite sensing band for measurement of rain, snow, ice, sea state, ocean wind, ocean surface temperature and soil moisture. The frequency band 13.25-13.75 GHz is intensively used for active remote sensing using altimeters, scatterometers and precipitation radars. The ITU-R studies conclude that “With additional allocation of spectrum to GSO FSS (space-to-Earth) on a primary basis in the band 10.6-10.68 GHz in Region 1, compatibility of the proposed GSO FSS (space-to-Earth) with passive services (EESS, SRS) and RAS, allocated in the shared frequency band, is not achieved as the interference protection level is not respected.” Based on the results of these studies there is no proposal to allocate the frequency band 10.6-10.7 GHz to the FSS in the draft CPM Report.

#### **WMO position relevant to the frequency band 10.6-10.7 GHz:**

WMO opposes to any allocation to the FSS in the frequency band 10.6-10.7 GHz.

### **3.2.2 The frequency band 13.25-13.75 GHz**

As far as the frequency band 13.25-13.75 GHz is concerned, a similar situation occurred during WARC-92 where the band 13.75-14 GHz, allocated to the EESS (active), was re-allocated to the FSS (Earth-to-space) even though it was recognized that these services are not compatible. Indeed, sharing between the EESS (active) and the FSS (Earth-to-space) around 13.5 GHz is known as not being practicable. No studies in preparation to WRC-15 proved otherwise. Any new allocation to the FSS (Earth-to-space) within the frequency band 13.25-13.75 GHz band would hence lead to a situation that further parts of the current EESS (active) primary allocation will become unusable in some or all Regions.

According ITU-R studies sharing between the FSS (space-to-Earth) and the EESS is feasible under specified conditions.

#### **WMO position relevant to the frequency band 13.25-13.75 GHz:**

**FSS (Earth-to-space)** – WMO supports no change to the Radio Regulations in this frequency band (i.e. Method D1 (for 13.25-13.4 GHz) and E1 (for 13.4-13.75 GHz) in draft CPM Report).

**FSS (space-to-Earth)** – WMO favours no change to the Radio Regulations in this frequency band. If an allocation to the FSS in the frequency band 13.25-13.75 GHz or a part of it is applied, the relevant protection of EESS sensors must be ensured by appropriate regulations based on the ITU-R study results.

## **3.3 Agenda item 1.9**

*“to consider, in accordance with Resolution 758 (WRC-12):”*

### **Agenda item 1.9.2**

*“the possibility of allocating the bands 7 375-7 750 MHz and 8 025-8 400 MHz to the maritime-mobile-satellite service and additional regulatory measures, depending on the results of appropriate studies.”*

Resolution 758 (WRC-12) calls for technical and regulatory studies on the possible new allocations to the maritime mobile-satellite service (MMSS) in the frequency bands

7 375-7 750 MHz (space-to-Earth) and 8 025-8400 MHz (Earth-to-space) while ensuring compatibility with existing services.

**The potentially affected frequency bands of WMO interest are:**

- 7 450-7 550 MHz allocated to the meteorological-satellite service (space-to-Earth) and limited to geostationary-satellite systems;
- 8 025-8 400 MHz allocated to the Earth exploration-satellite service (space-to-Earth).

**3.3.1 The frequency band 7 450-7 550 MHz**

No technical studies regarding sharing between the MMSS and MetSat in the frequency band 7 450-7 550 MHz have been performed.

**WMO position relevant to a possible new allocation of the frequency band 7 450-7 550 MHz to the MMSS (space-to-Earth):**

If an allocation to the MMSS (space-to-Earth) in this frequency band is applied the relevant protection of MetSat systems has to be ensured.

**3.3.2 The frequency band 8 025-8 400 MHz**

ITU-R sharing studies between the MMSS (Earth-to-space) and the EESS (space-to-Earth) in the 8 025-8 400 MHz show a requirement of several hundred kilometres separation distances to protect EESS earth stations. The large number of exclusion zones and the regulatory mechanisms for implementing and keeping them up-to-date are considered not implementable, which makes the protection of EESS earth stations from MMSS system interference impossible to ensure.

**WMO position relevant to a possible new allocation of the frequency band 8 025-8 400 MHz to the MMSS (Earth-to-space):**

Based on the ITU-R study results WMO opposes a new allocation of the frequency band 8 025-8 400 MHz to the MMSS (Earth-to-space) and supports no change to the Radio Regulations (i.e. Method A in draft CPM Report).

**3.4 Agenda item 1.10**

*“to consider spectrum requirements and possible additional spectrum allocations for the mobile-satellite service in the Earth-to-space and space-to-Earth directions, including the satellite component for broadband applications, including International Mobile Telecommunications (IMT), within the frequency range from 22 GHz to 26 GHz, in accordance with Resolution 234 (WRC-12).”*

Resolution 234 (WRC-12) calls for sharing and compatibility studies towards additional allocations to the mobile-satellite service in the Earth-to-space and space-to-Earth directions, within portions of the bands between 22 GHz and 26 GHz, while ensuring protection of existing services within these bands as well as taking into account RR No. 5.340 and RR No. 5.149.

Resolution 234 (WRC-12) also recognizes that unwanted emissions in the band 23.6-24 GHz will need to be limited to ensure protection of systems of the EESS (passive), SRS (passive) and radio astronomy services.

The main frequency bands at risk for WMO are:

- 1) The frequency band 23.6-24 GHz allocated to EESS (passive) (to be protected against unwanted emissions taking into account interference apportionment and the levels contained in Resolution 750 (Rev. WRC-12));

- 2) The first 500 MHz of the EESS/SRS space-to-Earth allocations in the frequency band 25.5-27.0 GHz.

A potential sharing of the EESS (space-to-Earth) with MSS is addressed in section 3.15.3 of the PDN Report ITU-R M.[MSS SHARE]. The study given in that Report shows that MSS operations in the band 25.5-26 GHz will create a potential for harmful interference to EESS links operating in the space-to-Earth direction. The study given in the PDN Report ITU-R M.[MSS SHARE] also shows that MSS operations in the bands 22.55-23.15 GHz, 23.15-23.55 GHz and 25.25-26 GHz will create a potential for harmful interference to ISS links supporting SRS, EESS and non-GSO MSS applications in the frequency bands 22.55-23.15, 23.15-23.55 GHz and 25.25-27.5 GHz.

No out-of-band compatibility studies have been performed to ensure protection of EESS (passive) systems operating in the frequency band 23.6-24 GHz from unwanted emissions of MSS systems.

**WMO position:**

Based on the ITU-R study results, noting in particular that no out-of-band compatibility studies have been performed to ensure protection of EESS (passive) systems from unwanted emissions of MSS systems, WMO opposes new allocation of the frequency bands between 22 GHz and 26 GHz to the MSS and supports no change to the Radio Regulations (i.e. Method A in draft CPM Report).

**3.5 Agenda item 1.11**

*“to consider a primary allocation for the Earth exploration-satellite service (Earth-to-space) in the 7-8 GHz range, in accordance with Resolution 650 (WRC-12).”*

Resolution 650 (WRC-12) calls for study of the spectrum requirements and compatibility studies in the 7-8 GHz frequency range for EESS (Earth-to-space) telecommand operations in order to complement telemetry operations of EESS (space-to-Earth) in the 8 025-8 400 MHz frequency band. Resolution 650 (WRC-12) indicates that priority is given to the frequency band 7 145-7 235 MHz and then within other portions of the 7-8 GHz range only if the band 7 145-7 235 MHz is found not to be suitable.

This new allocation would allow for uplinks and downlinks on the same transponder, increasing efficiency and reducing complexity of Earth observation satellites.

It should be noted that under WRC-15 agenda item 1.9.1 a possible new allocation to the FSS in the frequency band 7 150-7 250 MHz (space-to-Earth) is also being considered and it could have an impact on this agenda item.

ITU-R studies show that a 60 MHz primary worldwide allocation to the EESS (Earth-to-space) in the frequency band 7 190-7 250 MHz would satisfy the EESS requirements and would be compatible with existing services.

**WMO position:**

WMO supports a new global primary allocation to the EESS (Earth-to-space) in the frequency band 7 190-7 250 MHz (i.e. Method A in draft CPM Report).

**3.6 Agenda item 1.12**

*“to consider an extension of the current worldwide allocation to the Earth exploration-satellite (active) service in the frequency band 9 300-9 900 MHz by up to 600 MHz within the frequency bands 8 700-9 300 MHz and/or 9 900-10 500 MHz, in accordance with Resolution 651 (WRC-12).”*

Resolution 651 (WRC-12) invites ITU-R to conduct and complete, in time for WRC-15, compatibility studies addressing:

- the EESS (active) and existing services in the frequency bands 8 700-9 300 MHz and 9 900-10 500 MHz in order to ensure the protection of the existing services, taking into account the constraints as per RR No. 5.476A;
- unwanted emissions from stations operating in the EESS (active) within the frequency band 8 700-9 300 MHz into stations of the SRS operating in the frequency band 8 400-8 500 MHz;
- unwanted emissions from stations operating in the EESS (active) within the frequency band 9 900-10 500 MHz into stations of the RAS, SRS (passive) and EESS (passive) operating in the frequency band 10.6-10.7 GHz.

ITU-R studies show that there are several ways to extend of the current worldwide allocation to the EESS (active) by 600 MHz and provide the necessary protection to systems of the existing services (ARS, ARSS, FS, MetSat, MS, RLS, RNS, RAS, SRS).

### **WMO position:**

If an allocation to the EESS (active) is applied in the frequency range 9 GHz frequency range, adequate protection of meteorological applications has to be ensured.

### **3.7 Agenda item 1.17**

*“to consider possible spectrum requirements and regulatory actions, including appropriate aeronautical allocations, to support wireless avionics intra-communications (WAIC), in accordance with Resolution 423 (WRC-12).”*

Resolution **423 (WRC-12)** invites ITU-R to conduct the necessary studies to determine the spectrum requirements needed to support WAIC systems and also conduct sharing and compatibility studies to determine appropriate frequency bands and regulatory actions. WRC-12 requested to consider frequency bands within existing worldwide aeronautical mobile service, aeronautical mobile (R) service and aeronautical radionavigation service allocations and additional frequency bands above 15.7 GHz for aeronautical services if spectrum requirements cannot be met in already allocated frequency bands.

Potentially affected frequency bands of WMO interest below 15.7 GHz are:

- the frequency band 2 700-2 900 MHz allocated to the radiolocation service on a secondary basis and employed by ground-based weather radars in this frequency band;
- the frequency band 5 350-5 460 MHz allocated to the Earth exploration-satellite (active) service and to the radiolocation service (employed by ground-based meteorological radars in some countries);
- the frequency band 13.25-13.4 GHz allocated to the EESS (active) – subject to RR No. **5.498A**.

Studies in the frequency bands 2 700-2 900 MHz and 5 350-5 460 MHz between WAIC systems / applications and radiolocation systems conducted by ITU-R conclude that the sharing is not possible without large separation distance and, consequently, these frequency bands are not appropriate for the deployment of WAIC systems.

Potentially affected frequency band of WMO interest above 15.7 GHz is the frequency band 23.6-24 GHz allocated to the EESS (passive).

**WMO position:**

WMO opposes the use of the frequency bands 2 700-2 900 MHz and 5 350-5 460 MHz for WAIC based on the approved ITU-R studies which conclude that sharing between meteorological radars and WAIC is not feasible in these bands.

If other frequency bands were to be considered for WAIC (e.g. the frequency band 13.25-13.4 GHz or the frequency bands 22.5-22.55 GHz and 23.55-23.6 GHz), compatibility with meteorological and Earth observation applications would need to be assessed and the adequate protection has to be ensured.

**3.8 Agenda item 9.1, Issue 9.1.1**

*to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention: on the activities of the Radiocommunication Sector since WRC-12: Protection of the systems operating in the mobile-satellite service in the band 406-406.1 MHz. Resolution 205 (Rev.WRC-12).*

The revised Resolution 205 (Rev. WRC-12) resolves to conduct and complete in time for WRC-15, the appropriate regulatory, technical and operational studies with a view to ensuring the adequate protection of MSS systems in the frequency band 406-406.1 MHz from any emissions that could cause harmful interference (see RR No. 5.267).

It is known that current noise increase events of a number of Cospas-Sarsat search and rescue instruments (mainly over Europe and Asia) are due to emissions of services operated in adjacent bands and in particular the mobile service operated in the frequency bands 380-400 MHz and 406.1-420 MHz.

ITU-R studies confirmed that meteorological satellite systems uplinks and meteorological-aids systems (radiosondes) operating in the vicinity of the 406 MHz frequency band have no negative effect on Cospas-Sarsat receivers.

**WMO position:**

WMO supports regulatory measures towards ensuring the adequate protection to Cospas-Sarsat receivers against emissions from systems operating in adjacent bands, noting that, to a large extent, those receivers are implemented on meteorological satellites. Based on the results of ITU-R studies WMO supports revision of Resolution 205 (Rev.WRC-12) with a view of having adequate protection of the MSS systems in the frequency band 406-406.1 MHz in order to detect and successfully process distress signals, taking into account the current and future deployment of systems belonging to the services in adjacent frequency bands.

**3.9 Agenda item 9.1, Issue 9.1.5**

*“Consideration of technical and regulatory actions in order to support existing and future operation of fixed-satellite service earth stations within the band 3 400-4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1 (Resolution 154 (WRC-12)).”*

Resolution 154 (WRC-12) calls to study possible technical and regulatory measures in some countries in Region 1 to support the existing and future FSS earth stations in the frequency band 3 400-4 200 MHz used for satellite communications related to safe operation of aircraft and reliable distribution of meteorological information.

Ensuring the availability of the 3 400-4 200 MHz frequency band for the distribution of meteorological data via satellites is an important issue for the whole meteorological community and should be followed and supported in the framework of WMO.

ITU-R studies show a potential for interference from IMT and broadband wireless access stations into FSS earth stations at distances of up to several hundred kilometres. It is proposed to modify Resolution **154 (WRC-12)** calling for relevant administrations in Region 1 to use special care in the coordination, assignment, and management of frequencies taking into consideration the potential impact on FSS earth stations used for satellite communications related to safe operation of aircraft and reliable distribution of meteorological information in the frequency band 3 400-4 200 MHz.

**WMO position:**

WMO highlights its requirement to maintain relevant fixed-satellite service capacity and availability in the 3 400-4 200 MHz frequency band. WMO supports technical and regulatory actions to protect the FSS operations in the band 3 400-4 200 MHz for the dissemination of meteorological data in Region 1 and supports a revision of Resolution **154 (WRC-12)** calling for relevant administrations in Region 1 to use special care in the coordination, assignment, and management of frequencies as described in draft CPM Report.

**3.10 Agenda item 9.1, Issue 9.1.8**

*Consider and approve the Report of the Director on the ITU-R activities on regulatory aspects for nano- and picosatellites.*

**WMO position:**

Regulations for nano- and picosatellites shall not impact on the operation of EESS and MetSat satellite systems. To this respect nano- and picosatellite systems shall follow the same advanced publication, coordination and notification processes as other satellite systems and thus not be given advantage over other satellite systems.

**3.11 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 **808 (WRC-12)**)*

WMO will provide possible agenda items, as appropriate, and its position on other proposals in time for WRC-15.

At the current stage WMO support the following proposals for the future WRC agenda:

- to consider the upgrade of the secondary allocation to the meteorological satellite (space-to-Earth) service in the frequency band 460-470 MHz to a primary status while ensuring the protection of the existing primary services in this frequency band and review RR No. **5.289**;
- to consider a possible allocation to the Earth exploration-satellite (active) service for radar sounders in the frequency range of 40-50 MHz.

Considering information provided by the regional telecommunication organizations the future WRC agenda may include agenda item on the following issues that may have a negative effect on development and operation of meteorological systems and applications:

- to consider additional spectrum allocations to the mobile service on a primary basis for RLANs in the 5 350-5 470 MHz frequency range;
- to consider identification of spectrum for IMT applications in the mobile service above 6 GHz.

### **3.12 Other WRC-15 agenda items that may have an impact on WMO interests**

Other WRC-15 agenda items that may potentially have an impact on WMO interests are listed below. WMO monitors the development under these agenda items and reacts accordingly in order to protect meteorological interests.

#### **Agenda item 1.3**

review and revise Resolution **646 (Rev.WRC-12)** for broadband public protection and disaster relief (PPDR)

#### **WMO position:**

WMO is of the view that regulations for PPDR should not impact on the operation of meteorological systems and applications.

#### **Agenda item 1.5**

consider the use of frequency bands allocated to the fixed-satellite service for the control and non-payload communications of unmanned aircraft systems (UAS)

#### **WMO position:**

WMO is concerned with the frequency band 8 025-8 400 MHz allocated on a primary basis to EESS (space-to-Earth) and to FSS (Earth-to-space) and will object to the use of the 8 GHz FSS allocation for the CNPC links for the operation of UAS. WMO also considers that the protection of existing allocations to the Earth exploration-satellite service and other services employed by meteorological applications shall be ensured if WRC-15 decides on the usage of FSS for the CNPC links for the operation of UAS.

#### **Agenda item 1.9.1**

consider possible new allocations to the fixed-satellite service in the frequency bands 7 150-7 250 MHz (space-to-Earth) and 8 400-8 500 MHz (Earth-to-space).

#### **WMO position:**

WMO considers that studies under WRC-15 agenda item 1.9.1 should not have negative effect on a new EESS (Earth-to-space) allocation in 7-8 GHz frequency band under agenda item 1.11.

#### **Agenda item 1.18**

consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band

#### **WMO position:**

WMO supports a primary allocation to the radiolocation service in the 77.5-78 GHz frequency band under the assumption that this new allocation to the radiolocation service will facilitate moving automotive applications out of the 24 GHz “passive” frequency band currently used by automotive radars.

#### **Agenda item 7**

consider possible changes, and other options, an advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks

#### **WMO position:**

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



WMO will support changes to the Radio Regulations that would improve the advance publication, coordination, notification and recording procedures for satellite networks.

**Agenda item 9.1, Issue 9.1.2**

consider and approve the Report of the Director on the ITU-R activities on studies on possible reduction of the coordination arc and technical criteria used in application of RR No. **9.41** in respect of coordination under RR No. **9.7**

**WMO position:**

WMO supports studies on possible reduction of the coordination arc and technical criteria used in application of RR No. **9.41** in respect of coordination under RR No. **9.7** until they provide adequate protection and reduce unjustified restrictions for coordination of meteorological and Earth observation-satellite systems.

**Agenda item 9.1, Issue 9.1.6**

studies towards review of the definitions of *fixed service*, *fixed station* and *mobile station*

**WMO position:**

WMO supports maintaining a clear distinction in definitions of the fixed service and the mobile service, the fixed station and the mobile station in order to maintain availability and the relevant protection of meteorological and other relevant applications.

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