

# World Radiocommunication Conference 2019 and 2023 issues



**WMO OMM**

World Meteorological Organization  
Organisation météorologique mondiale

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# WRC -19

**Among the 27 agenda items:**

- \* 12 are related to issues of prime interest or concern for WMO**
- \* 7 may potentially have an impact on WMO interests**



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# AI 1.1 : Amateur service in the 50-54 MHz band (Resolution 658 (WRC-15))

- **Studies required**
  - Sharing between Amateur service and radiolocation limited to Wind Profilers in the 50-54 MHz band
- **Difficulties foreseen**
  - Primary status for amateur service against secondary status for radiolocation
  - Potential willingness to also include amateur-satellite service
- **ITU-R responsible group**
  - WP 5A
- **Preliminary WMO position**
  - No opposition to an allocation to amateur service in the 50-54 MHz provided that:
    - appropriate protection of radiolocation service allocated by RR No 5.162A is ensured and
    - the status of the new allocation to amateur service provides the radiolocation service equality or precedence relative to the amateur service.
  - Opposition to any new allocation to amateur-satellite service in this frequency band



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## AI 1.2 : Satellite hard limits at 400 MHz (Resolution 765 (WRC-15))

- **Studies required**
  - Sharing between telecommand links using these allocations and the current systems operating in this band for data collection within the METSAT (DCS) and the EESS (ARGOS) to ensure the proper continuation of their operations
- **Difficulties foreseen**
  - Cross-linkage with AI 1.7 on SOS allocation for small satellites for the band 401-403 MHz.
- **ITU-R responsible group**
  - WP 7B
- **Preliminary WMO position**
  - WMO supports the establishment of an appropriate set of in band power/e.i.r.p. limits to ensure the protection of existing and future use of meteorological operations (e.g. METSAT and EESS (Earth-to-space)) in the 401-403 MHz frequency band for both non-GSO and GSO Data Collection Station systems.



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## AI 1.3 : METSAT and EESS at 460-470 MHz (Resolution 766 (WRC-15))

- **Studies required**
  - Sharing of EESS (s-E) and METSAT (s-E) with FS and MS
  - Sharing between EESS (s-E) and METSAT (s-E)
- **Difficulties foreseen**
  - Band identified for IMT
- **ITU-R responsible group**
  - WP 7B
- **Preliminary WMO position**
  - WMO supports the upgrade of the METSAT (space-to-Earth) allocation to primary in the frequency band 460-470 MHz with the use of an appropriate PFD limit to protect incumbent services.
  - WMO also supports creation of a primary allocation to the EESS (space-to-Earth) in the frequency band 460-470 MHz with the use of an appropriate PFD limit to protect incumbent services, while retaining the priority of MetSat over EESS as currently expressed in footnote RR No. 5.289.



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# AI 1.6 : Non GSO FSS at 37.5-51.4 GHz (Resolution 159 (WRC-15))

- **Studies required**

- Compatibility between non GSO FSS (s-E) in the band 37.5-42.5 GHz and EESS (passive) in the band 36-37 GHz.
- Compatibility between non GSO FSS (E-s) in the bands 47.2-50.2 GHz and 50.4-51.4 GHz and EESS (passive) in the band 50.2-50.4 GHz.
- Sharing between non GSO FSS (s-E) and EESS (E-s) in the band 40-40.5 GHz.

- **Difficulties foreseen**

- There is no guard band available around the passive band 50.2-50.4 GHz.
- Problem of compatibility with ground-based radiometers in 50.4-51.4 GHz band in relation with the low status of radiometers

- **ITU-R responsible group**

- WP 4A

- **Preliminary WMO position**

- WMO supports the development of a regulatory framework (including revisions to Resolution 750 (Rev.WRC-15) for non-GSO FSS satellite systems in the 37.5-51.4 GHz range provided that protection of EESS (Earth-to-space) in the band 40-40.5 GHz and EESS (passive) in the bands 36-37 GHz and 50.2-50.4 GHz is ensured by including appropriate unwanted emission limits in Resolution 750 (Rev. WRC-15).
- WMO would appreciate the development of a solution to ensure the effective operation of the ground-based radiometers in the 50.4-51.4 GHz frequency band.



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## AI 1.7 : Small satellites (Resolution 659 (WRC-15))

- **Studies required**
  - Suitability of existing SOS allocation below 1 GHz
  - If no SOS existing allocation below 1 GHz is suitable, sharing of SOS with METAIDS, METSAT (E-s) and EESS (E-s) in the 400.15-406 MHz band
- **Difficulties foreseen**
  - Cross-linkage with AI 1.7 on SOS allocation for small satellites for the band 401-403 MHz
  - Risk of focus on the 400 MHz band
- **ITU-R responsible group**
  - WP 7B
- **Preliminary WMO position**
  - WMO emphasises that the frequency band 400.15-406 MHz is the key band for radiosondes and DCS worldwide operations and is concerned about its consideration under this agenda item.



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# AI 1.13 : IMT 5G - 1

## (Resolution 238 (WRC-15))

- **Studies required**

- Sharing with ISS and EESS (s-E) in the band 25.25 – 27.5 GHz
- Sharing with EESS (E-s) in the band 40-40.5 GHz
- Compatibility between IMT and EESS (passive) in the bands 23,6-24 GHz, 31.5-31.8 GHz, 36-37 GHz, 50.2-50.4 GHz, 52.6 - 54.25 GHz and 86-92 GHz

- **Difficulties foreseen**

- Footnotes in the band 25.5-27 GHz mentioning that EESS earth stations shall not claim protection from mobile service, and de facto, from IMT (5.536A).
- Nothing guarantees that the Administrations will still accept to give licensees in the future to deploy new, or even continue to operate current transmitting or receiving earth stations.
- No guard band available around the passive band 50.2-50.4 GHz.
- Problem of compatibility with ground-based radiometers in relation with the low status of radiometers

- **ITU-R responsible group**

- TG 5/1



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## AI 1.13 : IMT 5G - 2 (Resolution 238 (WRC-15))

- **Preliminary WMO position**

- WMO supports the need to conduct studies under agenda item 1.13. WMO does not oppose new IMT 5G identification/allocations provided that protection of ISS, EESS (Earth-to-space and space-to-Earth) and EESS (passive) is ensured and that guarantees are given on the long-term usage and future deployment of receiving EESS earth stations (in particular in the 25.5-27 GHz band).
- The protection of EESS (passive) would require appropriate unwanted emission limits in Resolution 750 (Rev. WRC-15).
- Furthermore, WMO would appreciate the development of a solution to ensure the effective operation of the ground-based radiometers in the 22-28 GHz and 50.4-51.4 GHz frequency bands.



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## AI 1.14 : HAPS (Resolution 160 (WRC-15))

- **Studies required**
  - Compatibility between HAPS in the band 21.4-22 GHz and EESS (passive) in the band 21.2-21.4 GHz
  - Sharing with ISS, EESS (s-E) in the band 25.25 – 27.5 GHz
- **Difficulties foreseen**
  - The frequency band 24.25-27.5 GHz is also considered for IMT. It is therefore likely that either one or the other will enter into the band 25.25-27.5 GHz used by scientific services.
  - HAPS donwlinks will have a more severe impact in EESS receiving earth stations than HAPS uplinks or IMT.
  - Problem of compatibility with ground-based radiometers in relation with the low status of radiometers
- **ITU-R responsible group**
  - WP 5C
- **Preliminary WMO position**
  - WMO does not oppose new HAPS band identifications provided that studies show a need for identification of additional spectrum for HAPS and that protection of ISS, EESS (space-to-Earth), and EESS (passive) is ensured and that guarantees are given on the long-term usage and future deployment of receiving EESS earth stations (in particular in the 25.5-27 GHz band).
  - The protection of EESS (passive) would require appropriate unwanted emission limits in Resolution 750 (Rev. WRC-15).
  - Furthermore, WMO would appreciate the development of a solution to ensure the effective operation of the ground-based radiometers in the 22-28 GHz frequency band.



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# AI 1.15 : FS/MS above 275 GHz (Resolution 767 (WRC-15))

- **Studies required**
  - Sharing and compatibility studies between the land-mobile, fixed and passive services operating in the frequency range 275-450 GHz depending on the exact bands targeted.
- **Difficulties foreseen**
  - Radio-astronomy has identified in 5.565 bands which are not identical to EESS (passive) ones, leaving no empty band in this frequency range for FS or MS, and therefore requiring sharing.
- **ITU-R responsible group**
  - WP 1A
- **Preliminary WMO position**
  - WMO does not oppose the identification of land-mobile and fixed services in the 275-450 GHz band provided that protection of EESS (passive) is ensured and the identification is consistent with footnote RR No. 5.565.
  - If allocations for active service are envisaged, the same approach would have to be applied to passive service.



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# AI 1.16 : RLAN 5 GHz -1

## (Resolution 239 (WRC-15))

- **Studies required**

- Participate in the RLAN requirements studies in order to verify the consistency of spectrum requirements with real needs as well as deployment scenarios.
- Studies to counter the rationales provided by the RLAN industry with regard to the applicability, efficiency and enforcement possibility of the proposed mitigation techniques.
- Additional studies on the compatibility between RLANs and altimeters/scatterometers (including revisiting studies performed prior WRC-03).
- Compatibility with meteorological radars in the 5350-5470 MHz, including assessment of DFS requirements

- **Difficulties foreseen**

- Same as for WRC-15 (high pressure from RLAN industry, ...).

- **ITU-R responsible group**

- WP 5A



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# AI 1.16 : RLAN 5 GHz -2 (Resolution 239 (WRC-15))

- **Preliminary WMO position**

- Due to potential for increasing interference to the EESS (active), WMO opposes relaxed restrictions that would allow the outdoor use of RLAN devices in the 5250-5350 MHz frequency band.
- 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 (active) systems.
- Furthermore WMO is concerned that the current situation in the band 5600-5650 MHz, regarding intentional illegal use and non-compliant RLAN systems by-passing the regulated mitigation technique and leading to interference to meteorological radars, will be repeated in the
- 5350-5470 MHz band and additionally affect EESS (active) and meteorological radars.



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# AI 9.1.5 : RLAN 5 GHz and reference to radar ITU-R recommendations

## (Resolution 764 (WRC-15))

- **Studies required**
  - To show that reference to Recommendation ITU-R M.1849-1 will have no impact on the conditions of use of the 5600-5650 MHz band by meteorological radars
- **Difficulties foreseen**
  - May have an impact on the decisions related to agenda item 1.16.
- **ITU-R responsible group**
  - WP 5A
- **Preliminary WMO position**
  - WMO supports referencing Recommendation ITU-R M.1849-1 in No 5.450A of the Radio Regulations in order to ensure the continued protection of meteorological radars from WAS/RLAN systems operating under the mobile service allocation in the 5470-5725 MHz frequency band.



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## AI 9.1.6 : Wireless Power Transmission (Resolution 958 (WRC-15))

- **Studies required**
  - To better understand the WPT principles and related propagation conditions
  - To confirm the frequency range under considerations for WPT (i.e. 20 to 6800 kHz range)
  - To assess the potential impact of WPT on lightning detection networks
- **Difficulties foreseen**
  - WPT characteristics are currently not fully known
- **ITU-R responsible group**
  - WP 1B
- **Preliminary WMO position**
  - WMO does not oppose to study the suitable harmonized frequency ranges for WPT provided that it does not impact operation of lightning detection networks operating in the 20-350 kHz range and oceanographic radars operating in the 5250-5275 kHz frequency band.



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## AI 9.1.9 : FSS at 51.4-52.4 GHz (Resolution 162 (WRC-15))

- **Studies required**
  - Compatibility between GSO FSS (E-s) in the band 51.4-52.4 GHz and EESS (passive) and ground based radiometers in the bands 50.2-50.4 GHz and 52.6-54.25 GHz .
- **Difficulties foreseen**
  - Contrary to the band 52.6-54.25 GHz, the band 50.2-50.4 GHz is not identified in the Resolution resolves 3, but studies can also be envisaged through resolves 2 depending on the interpretation of the term 'adjacent'.
- **ITU-R responsible group**
  - WP 4A
- **Preliminary WMO position**
  - WMO does not oppose to the possible allocation of the frequency band 51.4-52.4 GHz to the FSS (E-s) provided that protection of EESS (passive) in the bands 50.2-50.4 GHz and 52.6-54.25 GHz is ensured.
  - The protection of EESS (passive) would require appropriate unwanted emission limits in Resolution 750 (rev. WRC-15).
  - Furthermore, WMO would appreciate the development of a solution to ensure the effective operation of the ground-based radiometers in the 50.4-51.4 GHz frequency band.



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# WRC-19 agenda items that may have an impact on WMO interests (1)

- **Agenda item 1.11 : railway radiocommunication systems (Resolution 236 (WRC 15))**
- **Agenda item 1.12 : Intelligent Transport Systems (ITS) (Resolution 237 (WRC 15))**
- **Preliminary WMO position**

For these both AIs, since no specific frequency bands have currently been proposed for study, WMO does not have a specific concern on this agenda item. Consideration of frequency bands used for meteorological operations would increase WMO concerns.
- **Agenda item 2 : ITU R Recommendations incorporated by reference in the Radio Regulations (Resolution 28 (Rev.WRC 15) and Resolution 27 (Rev.WRC 12))**
- **Agenda item 4 : “in accordance with Resolution 95 (Rev.WRC 07), to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation.”**
- **Preliminary WMO position**

For these both AIs, WMO will monitor this AI to ensure that any possible change to the RR will not adversely impact any service used for meteorological needs.



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# WRC-19 agenda items that may have an impact on WMO interests (2)

- **Agenda item 7 : 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).**

## **Preliminary WMO position**

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

- **Agenda item 9.1.4 : Stations on board sub-orbital vehicles (Resolution 763 (WRC-15)).**

## **Preliminary WMO position**

WMO will monitor this AI to ensure that these measures will not adversely impact any service used for meteorological operations.

- **Agenda item 9.1.7 : Unauthorized terminals (see Resolution 958 (WRC-15)).**

## **Preliminary WMO position**

WMO will monitor this AI to ensure that any possible change will not adversely impact any service used for meteorological operations.

- **Agenda item 9.1. 8 : M2M (see Resolution 958 (WRC-15)).**

## **Preliminary WMO position**

WMO will monitor this AI to ensure that the results of these studies will not adversely impact any service used for meteorological operations.



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# Agenda for next WRCs (Res. 808 (WRC-12)) WRC-23

There are currently two items on the WRC-23 Preliminary Agenda supported by WMO:

- WRC-23 Preliminary agenda item 2.2- “to conduct, and complete in time for WRC 23, studies for a possible new 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, in accordance with Resolution 656 (WRC 15);
- WRC-23 Preliminary agenda item 2.3- “in accordance with Resolution 657 (WRC 15), to 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 providing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services;”



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# SUMMARY

## WRC-19

12 are related to issues of prime interest or concern for WMO :

- new needs
- protection of existing meteorological or scientific systems operating “in band” or in “adjacent band”

## WRC-23

Two items, supported by WMO, adopted by WRC-19 in the Preliminary Agenda regarding :

- spaceborne radar sounders
- space weather

⇒ Needs for important work and efforts during the whole study period

⇒ Active participation, in close cooperation with ITU of WMO members in ITU-R studies but also in regional organizations



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# Thank you Merci



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World Meteorological Organization  
Organisation météorologique mondiale

## RESOLUTION 658 (WRC-15)

### Allocation of the frequency band 50-54 MHz to the amateur service in Region 1

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a) that fully or partially harmonized worldwide frequency bands for radiocommunication services are desirable in order to achieve international operability;
- b) that there is a need to establish sharing conditions when considering frequency bands for possible additional allocations to any service,

*noting*

- a) that the frequency band 50-54 MHz is allocated to the amateur service on a primary basis in Region 2 and Region 3;
- b) that No. [5.169](#) of the Radio Regulations provides for an alternative allocation to the amateur service on a primary basis in a number of countries in Region 1;
- c) that No. [5.162A](#) of the Radio Regulations provides for an additional allocation to the radiolocation service on a secondary basis in a number of countries, limited to the operation of wind profiler radars in accordance with Resolution [217 \(WRC-97\)](#);
- d) that the frequency band 47-68 MHz is allocated to the broadcasting service on a primary basis in Region 1, and this band, or part of it, is allocated to the mobile service on a primary basis in a number of countries in Region 1;
- e) that No. [5.167](#) of the Radio Regulations and other relevant footnotes in this frequency band provide for alternative and additional allocations to the fixed, mobile and broadcasting services on a primary basis,

*resolves to invite the 2019 World Radiocommunication Conference*

to consider the results of the studies below and take appropriate actions, including spectrum allocation,

*invites ITU-R*

- 1 to study spectrum needs in Region 1 for the amateur service in the frequency band 50-54 MHz;
- 2 taking into account the results of the above studies, to study sharing between the amateur service and the mobile, fixed, radiolocation and broadcasting services, in order to ensure protection of these services.



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## RESOLUTION 765 (WRC-15)

### Establishment of in-band power limits for earth stations operating in mobile-satellite service, the meteorological-satellite service and the Earth exploration-satellite service in the frequency bands 401-403 MHz and 399.9-400.05 MHz

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a)* that the Earth exploration-satellite service (EESS) (Earth-to-space) and meteorological-satellite service (MetSat) (Earth-to-space) systems deployed in the frequency band 401-403 MHz and mobile-satellite service (MSS) (Earth-to-space) systems in the frequency band 399.9-400.05 MHz are currently used for data collection;
- b)* that these systems usually operate using moderate/low power levels;
- c)* that Recommendation ITU-R SA.2045 provides information on the performance and interference criteria for relevant geostationary-satellite orbit (GSO) and non-geostationary-satellite (non-GSO) data collection systems (DCS) in the frequency band 401-403 MHz;
- d)* that Recommendation ITU-R SA.2044 provides information on the current and future usage of non-GSO DCS in the frequency band 401-403 MHz, and the portioning of the frequency band to allow all DCS equal access to the spectrum;
- e)* that Recommendation ITU-R M.2046 provides a description, and the corresponding protection criteria for broadband noise and narrowband interference, of one MSS system that uses the frequency band 399.9-400.05 MHz (Earth-to-space);
- f)* that these EESS, MetSat and MSS systems are essential for monitoring and predicting climate change, monitoring oceans, weather and water resources, weather forecasting and assisting in protecting biodiversity, improving maritime security;
- g)* that a growing number of satellites are planned to use these frequency bands mainly for telecommand (see No. 1.135) (Earth-to-space) purposes under the EESS, MetSat or MSS allocations,



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## RESOLUTION 765 (WRC-15)

*considering further*

- a) that the output power levels of the earth stations referred to in *considering g)*, at the antenna port of these telecommand links (Earth-to-space), can be much higher than the moderate/low power levels traditionally used for the operation of EESS, MetSat or MSS system, service links in the frequency bands 401-403 MHz and 399.9-400.05 MHz referred to in *considering a)*;
- b) that, according to the ITU Radiocommunication Sector (ITU-R) Recommendations referred to in *considering c)*, *d)*, and *e)*, the frequency bands 401-403 MHz and 399.9-400.05 MHz are mainly currently dedicated to data collection platforms;
- c) that the operation of the telecommand links referred to in *considering g)* would cause harmful interference to the satellite receivers on board the satellites referred to in *considering a)*,

*recognizing*

- a) that it is necessary to have stable regulatory certainty in order to be able to provide long-term continuity for the operation of DCS;
- b) that these DCS represent a long-term effort and investment;
- c) that it is necessary to ensure the operations of existing and future systems that usually implement low or moderate output power levels for EESS, MetSat and MSS systems referred to in *considering a)*;
- d) that the establishment of in-band power limits for earth stations within the Radio Regulations applicable to the EESS, MetSat and MSS will bring confidence for DCS using these frequency bands,

*resolves to invite the 2019 World Radiocommunication Conference*

to take into account the results of ITU-R studies, and consider the possibility of establishing in-band power limits for earth stations in the EESS and MetSat in the frequency bands 401-403 MHz and in the MSS frequency band 399.9-400.05 MHz,



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## RESOLUTION 765 (WRC-15)

*invites ITU-R*

to conduct and complete, in time for WRC-19, the necessary technical, operational and regulatory studies on the possibility of establishing in-band power limits for earth stations in the EESS and MetSat in the frequency band 401-403 MHz and the MSS in the frequency band 399.9-400.05 MHz,

*invites administrations*

to participate actively in the studies and provide the technical and operational characteristics of the systems involved by submitting contributions to ITU-R,

*instructs the Secretary-General*

to bring this resolution to the attention of the World Meteorological Organization (WMO) and other international and regional organizations concerned.



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## RESOLUTION 766 (WRC-15)

### Consideration of possible upgrading of the secondary allocation to the meteorological-satellite service (space-to-Earth) to primary status and a primary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band 460-470 MHz

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a) that data collection systems (DCS) operate on geostationary and non-geostationary orbits in the meteorological-satellite (MetSat) service and the Earth exploration-satellite service (EESS) (Earth-to-space) systems in the frequency band 401-403 MHz;
- b) that DCS are essential for monitoring and predicting climate change, monitoring oceans, and water resources, weather forecasting and assisting in protecting biodiversity, improving maritime security;
- c) that most of these DCS have implemented satellite downlinks (space-to-Earth) in the frequency band 460-470 MHz which bring significant improvements to the operation of satellite DCS, such as the transmission of information to optimize the usage of the terrestrial data collection platforms;
- d) that the frequency band 460-470 MHz is currently allocated to MetSat (space-to-Earth) on a secondary basis;
- e) that No. [5.290](#) identifies some administrations that already have a primary MetSat allocation, subject to agreement obtained under No. **9.21**;
- f) that the frequency band 460-470 MHz is currently allocated to the fixed and mobile services on a primary basis and is widely used by these services;
- g) that there is a need to protect the fixed and mobile services in the frequency band 460-470 MHz and not to constrain their future development;
- h) that, according to No. [5.289](#), EESS applications, other than MetSat, may also be used in the frequency bands 460-470 MHz and 1 690-1 710 MHz for space-to-Earth transmissions, subject to not causing harmful interference to stations operating in accordance with the Table of Frequency Allocations;
- i) that No. [5.286AA](#) identifies the frequency band 450-470 MHz for use by administrations wishing to implement International Mobile Telecommunications (IMT),



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## RESOLUTION 766 (WRC-15)

*considering further*

- a) that at least one administration has adopted national regulatory provisions providing a power flux-density (pfd) limit of  $-152 \text{ dBW/m}^2/4 \text{ kHz}$  for protecting systems of the terrestrial services;
- b) that, in order to meet this limit, space agencies have designed and are implementing a spread spectrum solution, making the operation of at least one satellite DCS downlink operating in the frequency band 460-470 MHz compliant with the pfd limit mentioned in *considering further a)*,  
*recognizing*

- a) that it is necessary for MetSat and EESS operators to have stable regulatory certainty in order to be able to provide long-term continuity for this service of public interest, and that operating under a secondary allocation status is conflicting with this objective;
- b) that these space programmes represent long-term effort and investment that span across decades from the time when the programme is officially decided, through the development period and the launch phase to the time when the corresponding satellites are in operation;
- c) that space and meteorological agencies are investing in the continuity of these programmes providing subsequent satellites and payloads;
- d) that an upgrade to a primary status of the allocation of the frequency band 460-470 MHz to MetSat and EESS (space-to-Earth), alongside appropriate measures to ensure adequate protection of existing primary allocated services in that frequency band, will bring confidence for administrations and space agencies involved in satellite data collection programmes and for the public sectors funding the development and operation of such systems;
- e) that it is necessary to keep the priority of MetSat over EESS in the frequency band 460-470 MHz;
- f) that MetSat and EESS earth stations will not claim protection from stations in the fixed and mobile services;
- g) that the agreements obtained under No. [5.290](#) remain in force,



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## RESOLUTION 766 (WRC-15)

*resolves to invite the 2019 World Radiocommunication Conference*

to consider, **based on the results of ITU Radiocommunication Sector (ITU-R) studies, the possibility of upgrading the secondary MetSat (space-to-Earth) allocation to primary status and adding a primary EESS (space-to-Earth) allocation in the frequency band 460-470 MHz**, while providing protection and not imposing any additional constraints on existing primary services to which the frequency band is already allocated and in the adjacent frequency bands,

*invites ITU-R*

- 1 to conduct and complete, in time for WRC-19, sharing and compatibility studies to determine the feasibility of upgrading the MetSat (space-to-Earth) allocation to primary status, and the addition of a primary EESS (space-to-Earth) allocation in the frequency band 460-470 MHz, while protecting the primary fixed and mobile services to which the frequency band is already allocated and **maintaining the conditions contained in No. 5.289**;
- 2 to complete the studies, taking into account the present usage of the frequency band 460-470 MHz by incumbent services, to determine the appropriate pfd limit to be placed on MetSat (space-to-Earth) and EESS (space-to-Earth) to protect the existing primary services to which this frequency band is already allocated, provided that, if the studies conclude that a less restrictive pfd limit than that contained in *considering further a)* can protect incumbent services, then the pfd limit contained in *considering further a)* shall apply,

*invites administrations*

to participate actively in the studies and provide the technical and operational characteristics of the systems involved by submitting contributions to ITU-R,

*instructs the Secretary-General*

to bring this resolution to the attention of the World Meteorological Organization (WMO) and other international and regional organizations concerned.



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## RESOLUTION 159 (WRC-15)

### Studies of technical, operational issues and regulatory provisions for non-geostationary fixed-satellite services satellite systems in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space)

The World Radiocommunication Conference (Geneva, 2015),

*considering*

- a) the need to encourage the development and implementation of new technologies in the fixed-satellite service (FSS) at frequencies above 30 GHz;
- b) that FSS systems based on the use of new technologies above 30 GHz and associated with both geostationary (GSO) and non-geostationary (non-GSO) satellite constellations are capable of providing high-capacity and low-cost means of communication even to the most isolated regions of the world;
- c) that the Radio Regulations should enable the introduction of new applications of radiocommunication technology to ensure the operation of as many systems as possible in order to ensure efficient use of the spectrum;
- d) that, in accordance with No. **22.2**, non-GSO systems shall not cause unacceptable interference to GSO FSS and broadcasting-satellite service (BSS) networks and, unless otherwise specified in the Radio Regulations, shall not claim protection from GSO FSS and BSS satellite networks;
- e) that non-GSO FSS systems would benefit from the certainty that would result from the specification of measures required to protect GSO FSS and BSS satellite networks under No. **22.2**;
- f) that in the FSS, there are GSO satellite networks and non-GSO satellite systems operating and/or planned for near-term operation in the frequency band allocated to the FSS in the range 37.5-51.4 GHz;
- g) that technical studies are required in order to ascertain the feasibility of, and conditions for, non-GSO FSS satellite systems sharing the frequency bands 37.5-42.5 GHz (space-to-Earth) and 47.2-50.2 GHz (Earth-to-space): 1) with GSO satellite networks (FSS, MSS and BSS, as appropriate to the band), and 2) with other non-GSO FSS satellite systems;
- h) that review of Resolution [750 \(Rev.WRC-15\)](#) may be required to take into account new development of non-GSO satellites,



WMO OMM

## RESOLUTION 159 (WRC-15)

*considering further*

that Recommendations ITU-R S.1323, ITU-R S.1325, ITU-R S.1328, ITU-R S.1529 and ITU-R S.1557 provide information on system characteristics, operational requirements and protection criteria that may be used in sharing studies,

*noting*

- a) that filing information for GSO FSS satellite networks in the frequency bands 37.5-42.5 GHz (space-to-Earth), 49.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) has been communicated to the Radiocommunication Bureau;
- b) that some of these GSO satellite networks are in operation and others will be operated in the near future;
- c) that the frequency band 37.5-38 GHz is allocated to the space research service (deep space) in the space-to-Earth direction and **the frequency band 40.0-40.5 GHz is allocated to the space research service and the Earth exploration-satellite service in the Earth-to-space direction on a primary basis;**
- d) that the frequency band 37.5-40.5 GHz is allocated to the Earth exploration-satellite service in the space-to-Earth direction on a secondary basis,



WMO OMM

## RESOLUTION 159 (WRC-15)

*recognizing*

- a) that WRC-2000 adopted provisions, including epfd limits in Nos. **22.5C**, **D** and **F** to quantify No. **22.2**, in order to protect GSO FSS and BSS satellite networks from non-GSO FSS satellite systems in the 10-30 GHz frequency range;
- b) that Resolution [76 \(Rev.WRC-15\)](#) contains aggregate power levels not to be exceeded by non-GSO FSS systems in order to protect against interference GSO FSS and GSO BSS networks in the 10-30 GHz frequency range;
- c) that No. [5.552](#) urges administrations to take all practicable steps to reserve the frequency band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service operating in the frequency band 40.5-42.5 GHz;
- d) that No. [5.554A](#) limits the use of the frequency bands 47.5-47.9 GHz, 48.2-48.54 GHz and 49.44-50.2 GHz by the fixed-satellite service (space-to-Earth) to geostationary satellites;
- e) that No. **21.16** contains power flux-density limits applicable to non-GSO satellite systems to protect fixed and mobile services with allocations in the frequency band 37.5-42.5 GHz;
- f) that the frequency band 50.2-50.4 GHz is allocated on a primary basis to the EESS (passive) and space research (passive) services, which must be adequately protected;
- g) that WRC-03, having considered the outcome of preliminary ITU-R studies, decided that further studies would be needed to determine the conditions for non-GSO FSS satellite systems to share the 37.5-50.2 GHz frequency range with GSO FSS satellite networks;
- h) that No. [5.556](#) indicates that radio astronomy observations are carried out in the frequency band 51.4-54.25 GHz and that mitigation measures may have to be defined in this regard;
- i) that any potential revisions to limitations for the protection of passive services or radio astronomy observations will necessarily be forward-looking, and will be impractical to apply to FSS networks and systems described in *considering f)* and *noting a)* and *b)*,



WMO OMM

## RESOLUTION 159 (WRC-15)

*resolves to invite ITU-R*

to conduct, and complete in time for WRC-19:

- 1 studies of technical and operational issues and regulatory provisions for the operation of non-GSO FSS satellite systems in the frequency bands 37.5-42.5 GHz (space-to-Earth) and 47.2-48.9 GHz (limited to feeder links only), 48.9-50.2 GHz and 50.4-51.4 GHz (all Earth-to-space), while ensuring protection of GSO satellite networks in the FSS, MSS and BSS, without limiting or unduly constraining the future development of GSO networks across those bands, and without modifying the provisions of Article 21;
- 2 studies carried out under *resolves to invite ITU-R 1* shall focus exclusively on the development of equivalent power flux-density limits produced at any point in the GSO by emissions from all the earth stations of a non-GSO system in the fixed-satellite service or into any geostationary FSS earth station, as appropriate;
- 3 studies and development of sharing conditions between non-GSO FSS systems operating in the frequency bands listed in *resolves to invite ITU-R 1* above;
- 4 studies of possible necessary revisions to Resolution [750 \(Rev.WRC-15\)](#) to ensure protection of the EESS (passive) in the frequency bands 36-37 GHz and 50.2-50.4 GHz from non-GSO FSS transmission, taking into account *recognizing i)* above, including study of aggregate FSS interference effects from networks and systems operating or planned to operate in the frequency bands described in *resolves to invite ITU-R 1* above;
- 5 studies towards ensuring protection of the radio astronomy frequency bands 42.5-43.5 GHz, 48.94-49.04 GHz and 51.4-54.25 GHz from non-GSO FSS transmissions, taking into account *recognizing i)* above, including study of aggregate FSS interference effects from networks and systems operating or planned to operate in the frequency bands described in *resolves to invite ITU-R 1* above,

*further resolves*

to invite WRC-19 to consider the results of the above studies and take appropriate action,

*invites administrations*

to participate in the studies by submitting contributions to ITU-R.



WMO OMM





## RESOLUTION 659 (WRC-15)

### Studies to accommodate requirements in the space operation service for non-geostationary satellites with short duration missions

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a) that the term “short duration mission” used in this resolution refers to a mission having a limited period of validity of not more than typically three years;
- b) that examples of such satellites are given in Report ITU-R SA.2312, which provides technical characteristics;
- c) that Report ITU-R SA.2348 provides an overview of the current practice and procedures for notifying space networks currently applicable to these satellites;
- d) that, since the number of these satellites is growing, the demand for suitable allocations to the space operation service may increase;
- e) that it is important to ensure that any satellite radio-frequency operation avoids harmful interference to other systems and services;
- f) that the frequency bands below 1 GHz are used for a wide variety of terrestrial and space applications, that some of these frequency bands are heavily used and new allocations to the space operation service in these frequency bands should not put undue constraints on incumbent services;
- g) that some non-amateur satellites have used frequencies for telemetry, tracking and command in the frequency bands 144-146 MHz and 435-438 MHz which are allocated to the amateur-satellite service, and that such use is not in accordance with Nos. **1.56** and **1.57**;
- h) that, according to No. **1.23**, telemetry, tracking and command functions for satellites will normally be provided within the service in which the space station is operating;
- i) that these satellites are constrained in terms of low on-board power and low antenna gain as described in Report ITU-R SA.2312;
- j) that the bandwidth currently used by these satellites for telemetry, tracking and command in frequency bands below 1 GHz, as described in Report ITU-R SA.2312, is generally 0.1 MHz or less,



WMO OMM

## RESOLUTION 659 (WRC-15)

*further considering*

- a) that these satellites may provide an affordable means to access orbital resources (spectrum and orbit) for new entrants in space;
- b) that the mass and dimensions of these satellites have been some of the major contributing factors to their success among new spacefaring nations;
- c) that the reliable control and tracking of satellites is important for the management of space debris,

*recognizing*

- a) that the existing allocations to the space operation service below 1 GHz, where No. **9.21** applies, are not suitable for the satellites referred to in *considering a)* and *b)*;
- b) that there are other frequency bands already allocated to the space operation service below 1 GHz where No. **9.21** does not apply;
- c) the provisions contained in No. [5.266](#) and No. [5.267](#) and Resolution [205 \(Rev.WRC-15\)](#),

*resolves to invite the 2019 World Radiocommunication Conference*

to consider the results of ITU-R studies and take necessary action, as appropriate, provided that the results of the studies referred to in *invites ITU-R* below are complete and agreed by study groups,

*invites ITU-R*

- 1 to study the spectrum requirements for telemetry, tracking and command in the space operation service for the growing number of non-GSO satellites with short duration missions, taking into account No. **1.23**;
- 2 to assess the suitability of existing allocations to the space operation service in the frequency range below 1 GHz, taking into account *recognizing a)* and current use;
- 3 if studies of the current allocations to the space operations service indicate that **requirements cannot be met under *invites ITU-R 1 and 2***, to conduct sharing and compatibility studies, and study mitigation techniques to protect the incumbent services, both in-band as well as in adjacent bands, in order to consider possible new allocations or an upgrade of the existing allocations to the space operation service within the frequency ranges 150.05-174 MHz and **400.15-420 MHz**,

*invites Member States and ITU-R Sector Members, Associates and Academia*

to participate in studies by submitting contributions to ITU-R.



WMO OMM



## RESOLUTION 238 (WRC-15)

### **Studies on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond**

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a)* that International Mobile Telecommunications (IMT) is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;
- b)* that IMT systems have contributed to global economic and social development;
- c)* that IMT systems are now being evolved to provide diverse usage scenarios and applications such as enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications;
- d)* that ultra-low latency and very high bit rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that are currently identified for use by administrations wishing to implement IMT;
- e)* that it may be suitable to examine higher frequency bands for these larger blocks of spectrum;
- f)* that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;
- g)* that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems including MIMO and beam-forming techniques in supporting enhanced broadband;
- h)* that ITU-T has initiated the study of network standardization for IMT for 2020 and beyond;
- i)* that adequate and timely availability of spectrum and supporting regulatory provisions is essential to realize the objectives in Recommendation ITU-R M.2083;
- j)* that harmonized worldwide bands and harmonized frequency arrangements for IMT are highly desirable in order to achieve global roaming and the benefits of economies of scale;
- k)* that identification of frequency bands allocated to mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require additional regulatory actions;
- l)* **the need to protect existing services and to allow for their continued development when considering frequency bands for possible additional allocations to any service,**



**WMO OMM**

## RESOLUTION 238 (WRC-15)

### *considering*

- a) that Resolution ITU-R 65 addresses the principles for the process of development of IMT for 2020 and beyond, and that Question ITU-R 77-7/5 considers the needs of developing countries in the development and implementation of IMT;
- b) that Question ITU-R 229/5 seeks to address the further development of IMT;
- c) that IMT encompasses both IMT-2000, IMT-Advanced, and IMT-2020 collectively, as described in Resolution ITU-R 56-2;
- d) Recommendation ITU-R M.2083, on the framework and objectives of the future development of IMT for 2020 and beyond;
- e) that Report ITU-R M.2320 addresses future technology trends of terrestrial IMT systems;
- f) Report ITU-R M.2376, on technical feasibility of IMT in the frequency bands above 6 GHz;
- g) that Report ITU-R M.2370 analyses trends impacting future IMT traffic growth beyond the year 2020 and estimates global traffic demands for the period 2020 to 2030;
- h) that there are ongoing studies within ITU-R on the propagation characteristics for mobile systems in higher frequency bands;
- i) the relevance of provisions in Nos. [5.340](#), [5.516B](#), [5.547](#) and [5.553](#), which may need to be taken into account in studies;
- j) that the FSS allocation in the frequency band 24.65-25.25 GHz was made by WRC-12,

### *recognizing*

- a) that there is a lead time between the allocation of frequency bands by world radiocommunication conferences and the deployment of systems in those bands, and that timely availability of wide and contiguous blocks of spectrum is therefore important to support the development of IMT;
- b) that frequency bands allocated to passive services on an exclusive basis are not suitable for an allocation to the mobile service;
- c) that any identification of frequency bands for IMT should take into account the use of the bands by other services and the evolving needs of these services;
- d) that there should be no additional regulatory or technical constraints imposed to services to which the band is currently allocated on a primary basis,



WMO OMM

## RESOLUTION 238 (WRC-15)

*resolves to invite ITU-R*

1 to conduct and complete in time for WRC-19 the appropriate studies to determine the spectrum needs for the terrestrial component of IMT in the **frequency range between 24.25 GHz and 86 GHz**, taking into account:

- technical and operational characteristics of terrestrial IMT systems that would operate in this frequency range, including the evolution of IMT through advances in technology and spectrally efficient techniques;
- the deployment scenarios envisaged for IMT-2020 systems and the related requirements of high data traffic such as in dense urban areas and/or in peak times;
- the needs of developing countries;
- the time-frame in which spectrum would be needed;

2 to conduct and complete in time for WRC-19 the appropriate sharing and compatibility studies<sup>1</sup>, **taking into account the protection of services to which the band is allocated on a primary basis**, for the frequency bands:

- **24.25-27.5 GHz<sup>2</sup>**, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz, **which have allocations to the mobile service on a primary basis**; and
- 31.8-33.4 GHz, 40.5-42.5 GHz and 47-47.2 GHz, **which may require additional allocations to the mobile service on a primary basis**,



WMO OMM

## RESOLUTION 238 (WRC-15)

### *further resolves*

- 1 to invite CPM19-1 to define the date by which technical and operational characteristics needed for sharing and compatibility studies are to be available, to ensure that studies referred to in *resolves to invite ITU-R* can be completed in time for consideration at WRC-19;
- 2 to invite WRC-19 to consider, based on the results of the above studies, additional spectrum allocations to the mobile service on a primary basis and to consider identification of frequency bands for the terrestrial component of IMT; the bands to be considered being limited to part or all of the bands listed in *resolves to invite ITU-R 2*,

### *invites administrations*

to participate actively in these studies by submitting contributions to ITU-R.

1 Including studies with respect to services in adjacent bands, as appropriate.

2 When conducting studies in the band 24.5-27.5 GHz, to take into account the need to ensure the protection of existing earth stations and the deployment of future receiving earth stations under the EESS (space-to-Earth) and SRS (space-to-Earth) allocation in the frequency band 25.5-27 GHz.

## RESOLUTION 160 (WRC-15)

### **Facilitating access to broadband applications delivered by high-altitude platform stations**

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a)* that there is a need for greater broadband connectivity and telecommunication services in underserved communities and in rural and remote areas;
- b)* that current technologies can be used for broadband applications delivered by base stations operating at high altitudes;
- c)* that high-altitude platform stations (HAPS) are one possible means for providing fixed broadband connectivity that would enable wireless broadband deployment in remote areas, including mountainous, coastal and sandy desert areas;
- d)* that HAPS using inter-HAPS links can provide broadband connectivity with minimal ground network infrastructure;
- e)* that HAPS may also be used for disaster recovery communications;
- f)* that some new entities are currently testing the delivery of broadband over lightweight, solar-powered aircraft and airships at an altitude of 20-50 kilometres for several months at a nominal fixed point relative to the ground below,

## RESOLUTION 160 (WRC-15)

### *recognizing*

- a) that existing services and their applications shall be protected from HAPS applications, and no undue constraints shall be imposed on the future development of existing services by HAPS;
- b) that HAPS is defined in No. **1.66A** of the Radio Regulations as a station located on an object at an altitude of 20-50 km and at a specified, nominal, fixed point relative to the Earth, and is subject to No. **4.23**;
- c) that WRC-97 added a global identification for HAPS in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, that WRC-2000 agreed, because of concerns with rain fade in that frequency range, on a HAPS identification for the frequency band 27.9-28.2 GHz (fixed downlink), paired with the frequency band 31.0-31.3 GHz (fixed uplink), outside Region 2, and that at WRC-12 five countries joined footnote [5.457](#) for a HAPS designation in the fixed service for frequency bands 6 440-6 520 MHz (HAPS-to-ground) and 6 560-6 640 MHz (ground-to-HAPS);
- d) that WRC-2000 decided on additional spectrum identifications for HAPS links under No. [5.388A](#) and No. [5.388B](#) in some countries;
- e) that the existing HAPS identifications were established without reference to today's broadband capabilities;
- f) that Recommendation [34 \(Rev.WRC-12\)](#) noted that the development of common worldwide allocations is desirable in order to improve and harmonize utilization of the radio-frequency spectrum;
- g) that, since WRC-12, the evolution of technology through advances in solar panel efficiency, battery energy density, lightweight composite materials, autonomous avionics and antenna technology may improve HAPS viability;
- h) that the allotments of the Appendix **30B** Plan, assignments in the Plans and the List subject to Appendix **30** and **30A** and assignments in the Appendix **30B** List shall be protected,



WMO OMM



## RESOLUTION 160 (WRC-15)

*resolves to invite ITU-R*

- 1 to study additional spectrum needs for gateway and fixed terminal links for HAPS to provide broadband connectivity in the fixed service taking into account:
  - the existing identifications and deployments of HAPS systems;
  - the deployment scenarios envisioned for HAPS broadband systems and related requirements such as in remote areas;
  - the technical and operational characteristics of HAPS systems, including the evolution of HAPS through advances in technology and spectrally-efficient techniques, and their deployment;
- 2 to study the suitability of using the existing identifications in *recognizing c)*, on a global or regional level, taking into account the regulatory provisions, such as geographical and technical restrictions associated with existing HAPS identifications based on the study performed in *resolves to invite ITU-R 1*;
- 3 to study appropriate modifications to the existing footnotes and associated resolutions in the identifications in *recognizing c)* in order to facilitate the use of HAPS links on a global or regional level, limited to the currently identified frequency bands and, where the use of an identification is not technically feasible for HAPS use, the possible removal of the unsuitable identification;
- 4 to study, in order to meet any spectrum needs which could not be satisfied under *resolves to invite ITU-R 1* and 2, for the use of gateway and fixed terminal links for HAPS, the following frequency bands already allocated to the fixed service on a primary basis, not subject to Appendices **30**, **30A**, and **30B** in any region:
  - on a global level: 38-39.5 GHz, and
  - on a regional level: in Region 2, 21.4-22 GHz and 24.25-27.5 GHz,



WMO OMM

## RESOLUTION 160 (WRC-15)

### *further resolves*

- 1 that the studies referred to in *resolves to invite ITU-R 3* and 4 include sharing and compatibility studies to ensure protection of existing services allocated in the frequency ranges identified and, as appropriate, adjacent band studies, taking into account studies already performed in ITU-R;
- 2 that modifications studied under *resolves to invite ITU-R 3* shall not consider the use of HAPS links in the frequency bands subject to Appendix **30B**;
- 3 to develop ITU-R Recommendations and Reports, as appropriate, on the basis of the studies called for in *resolves to invite ITU-R 1, 2, 3, and 4* above,

### *invites administrations*

to participate in the studies and to provide input contributions,

### *resolves to invite the 2019 World Radiocommunication Conference*

to consider the results of the above studies and take necessary regulatory actions, as appropriate, provided that the results referred to in *resolves to invite ITU-R* are complete and agreed by study groups.



WMO OMM



## RESOLUTION 767 (WRC-15)

### **Studies towards an identification for use by administrations for land-mobile and fixed services applications operating in the frequency range 275-450 GHz**

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a) that a number of bands in the frequency range 275-1 000 GHz are identified for use by administrations for passive services, such as the radio astronomy service, the Earth exploration-satellite service (passive) and the space research service (passive);
- b) that No. [5.565](#) states that the use of the range above 275 GHz by the passive services does not preclude use of this range by active services;
- c) that administrations wishing to make available frequencies in the 275-1 000 GHz range for active service applications are urged to take all practicable steps to protect these passive services from harmful interference until the date when the Table of Frequency Allocations is established for the relevant frequencies;
- d) that active devices which can operate at frequencies above 275 GHz are available due to technology developments;
- e) that studies on technical and operational characteristics of some active services operating in the range 275-1 000 GHz have been carried out by the ITU Radiocommunication Sector (ITU-R);
- f) that the technical and operational characteristics of land-mobile and fixed services operating in the bands above 275 GHz have not been specified, and further studies are required;
- g) that propagation characteristics of the frequencies above 275 GHz are being studied by ITU-R Study Group 3;
- h) that propagation models for the land-mobile and fixed services operating in the band above 275 GHz are required;
- i) that sharing and compatibility studies between land-mobile, fixed and passive services identified by No. [5.565](#) operating in the band above 275 GHz are required,



WMO OMM

## RESOLUTION 767 (WRC-15)

### *noting*

- a) that Question ITU-R 228-1/3 addresses the study of which propagation models best describe the relationship between atmospheric parameters and electromagnetic wave characteristics on terrestrial links operating at frequencies above 275 GHz;
- b) that Question ITU-R 235-1/7 addresses the study of the technical and operational characteristics of systems operating at frequencies above 275 GHz within the science services;
- c) that Question ITU-R 237/1 addresses the study of the technical and operational characteristics of active services in the frequency range 275-1 000 GHz;
- d) that Question ITU-R 256-0/5 addresses studies on the technical and operational characteristics of the land-mobile service in the frequency range 275-1 000 GHz;
- e) that Question ITU-R 257-0/5 addresses studies on the technical and operational characteristics of the fixed service in the frequency range 275-1 000 GHz;
- f) that other international organizations are developing standards for the suitable frequency ranges for ultra-high-speed (100 Gbps) data communication systems for Wireless Personal Area Network (WPAN);
- g) that several ultra-high-speed data communication systems are identified by other international standards bodies,

### *recognizing*

that other active services, including the radiolocation service and the amateur service, are also developing and demonstrating applications above 275 GHz,

### *resolves to invite the 2019 World Radiocommunication Conference*

taking into account the results of ITU-R studies on sharing and compatibility between passive and active services as well as spectrum needs for those services, to consider identification for use by administrations for the land-mobile and fixed service applications operating in the frequency range 275-450 GHz, while maintaining protection of the passive services identified in No. **5.565**, and take appropriate action,



WMO OMM

## RESOLUTION 767 (WRC-15)

*invites ITU-R*

- 1 to identify technical and operational characteristics of systems in the land-mobile and fixed services operating at frequencies above 275 GHz;
- 2 to study spectrum needs of systems in the land-mobile and fixed services, taking into account the results of the above studies;
- 3 to develop propagation models within the frequency range 275-450 GHz so as to enable sharing and compatibility studies between the land-mobile, fixed and passive services in this frequency range;
- 4 to conduct sharing and compatibility studies between the land-mobile, fixed and passive services operating in the frequency range 275-450 GHz, while maintaining protection of the passive services identified in No. [5.565](#);
- 5 to identify candidate frequency bands for use by systems in the land-mobile and fixed services, taking into account the results of the studies under *invites ITU-R* 1, 2 and 4, and the protection of passive services identified in No. [5.565](#),

*encourages Member States, Sector Members, Associates and Academia*

to submit contributions during the study period on their assessment of the impact on the identified services, based on the studies carried out under this resolution.



WMO OMM



## RESOLUTION 239 (WRC-15)

### Studies concerning Wireless Access Systems including radio local area networks in the frequency bands between 5 150 MHz and 5 925 MHz

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a) that there has been considerable growth in the demand for Wireless Access Systems including radio local area networks (WAS/RLAN) applications with multimedia capabilities;
- b) that WAS/RLAN applications contribute to global economic and social development by providing a wide range of multimedia applications;
- c) that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and facilitate spectrum access;
- d) that as technology evolves to meet increasing performance demands and traffic on broadband WAS increases, the use of wider bandwidth channels in order to support high data rates creates a need for additional spectrum;
- e) that the frequency band 5 350-5 460 MHz is allocated worldwide on a primary basis to the aeronautical radionavigation service (No. [5.449](#));
- f) that the frequency band 5 460-5 470 MHz is allocated worldwide on a primary basis to the radionavigation service (No. [5.449](#));
- g) that the frequency band 5 350 to 5 470 MHz is allocated worldwide on a co-primary basis to the Earth exploration-satellite service (active) (No. [5.448B](#)), the space research service (active) (No. [5.448C](#)) and the radiolocation service (No. [5.448D](#));
- h) that the frequency bands between 5 725 and 5 850 MHz are allocated worldwide on a primary basis to the radiolocation service and, in Region 1, to the fixed-satellite service;
- i) that the frequency band 5 850-5 925 MHz is allocated worldwide on a primary basis to the mobile service, the fixed service and the fixed-satellite service;
- j) that there is a need to protect the incumbent primary services including their current and planned use;
- k) that there may be a need to specify potential technical and operational restrictions for WAS/RLAN operating in the mobile service within the 5 GHz frequency range to facilitate sharing with systems of incumbent services,

## RESOLUTION 239 (WRC-15)

*considering further*

- a) that adequate and timely availability of spectrum and supporting regulatory provisions are essential to support future growth of WAS/RLAN applications;
- b) that harmonized worldwide bands that support future growth of WAS/RLAN applications are highly desirable in order to achieve the benefits of economies of scale,

*noting*

a) that the frequency bands 5 150- 5 250 MHz, 5 250- 5 350 MHz and 5 470- 5 725 MHz are allocated to the mobile service on a primary basis for the implementation of WAS/RLAN applications in accordance with Resolution [229 \(Rev.WRC-12\)](#);

b) that the frequency band 5 250-5 850 MHz is allocated worldwide on a primary basis to the radiolocation service;

c) that in the frequency bands 5 350 -5 470 MHz there are no primary mobile allocations;

d) that in the frequency band 5 725-5 850 MHz there is no primary mobile allocation, however, the band is allocated by footnote to the fixed and mobile service in some countries, and additionally WAS/RLAN use is already authorized in some countries situated in each of the ITU-R regions;

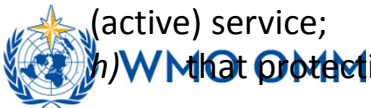
e) that the Earth exploration-satellite service (active) allocations in the frequency bands 5 350- 5 460 MHz and 5 460-5 470 MHz are essential for Earth-observation programmes such as Copernicus (Sentinel-1 and Sentinel-3), Jason, Sentinel-6 and RADARSAT (RADARSAT-2 and RADARSAT-3) and that the data these provide is vital for reliable and up-to-date information on how our planet and its climate are changing;

ebis) that future Earth exploration-satellite service (active) systems are being planned to utilize up to 300 MHz of bandwidth within the 5 GHz EESS allocated frequency band to improve image resolution and provide improved applications to users;

f) that the frequency band 5 150-5 250 MHz is also allocated worldwide on a primary basis to the aeronautical radionavigation service and to the fixed-satellite service (No. [5.447A](#));

g) that the frequency bands between 5 250 and 5 350 MHz are also allocated worldwide on a primary basis to the Earth exploration-satellite service (active), the space research service and the space research (active) service;

h) that protection and performance criteria for systems of incumbent services are available in ITU-R,



## RESOLUTION 239 (WRC-15)

*recognizing*

- a) that the compatibility studies performed by ITU-R in preparation for this conference indicate that when assuming the use of WAS/RLAN mitigation measures limited to the regulatory provisions of Resolution [229 \(Rev.WRC-12\)](#), sharing between WAS/RLAN and the EESS (active) systems in the frequency bands 5 350 to 5 470 MHz would not be feasible, as well as being insufficient to ensure protection of certain radar types in this frequency band; for these cases, sharing may only be feasible if additional WAS/RLAN mitigation measures are implemented, however, no agreement was reached on the applicability of any additional WAS/RLAN mitigation techniques;
- b) that the results of ITU-R studies indicate that the minimum spectrum need for WAS/RLAN in the 5 GHz frequency range in the year 2018 is estimated at 880 MHz; this figure includes 455-580 MHz already utilized by non-IMT mobile broadband applications operating within the 5 GHz range resulting in 300-425 MHz additional spectrum being required;
- c) that WAS/RLAN devices utilize the following frequency bands in the 5 GHz frequency range: 5 150-5 250 MHz, 5 250-5 350 MHz, 5 470-5 725 MHz and, in some countries 5 725-5 850 MHz;
- d) that the frequency band 5 850-5 925 MHz is extensively used in some countries by the fixed-satellite service;
- e) that additional global allocations to the mobile service in the frequency bands 5 350-5 470 MHz and 5 725-5 850 MHz would facilitate contiguous spectrum for WAS/RLAN, thereby enabling the use of wider channel bandwidths to support higher data throughput;
- f) that sharing studies should consider additional mitigation techniques to ensure that WAS/RLAN devices would not result in degradation of the performance for existing systems;
- g) that the application of possible additional WAS/RLAN mitigation measures referred to in *recognizing a)* may also be relevant to enable WAS/RLAN outdoor operation in other frequency bands;
- h) that the frequency band 5 725-5 875 MHz is also designated for industrial, scientific and medical (ISM) applications and that radiocommunication services operating within this frequency band must accept harmful interference which may be caused by these applications in accordance with No. [5.150](#),

*resolves to invite the 2019 World Radiocommunication Conference*

to consider the results of the ITU-R studies and take appropriate actions,



WMO OMM



## RESOLUTION 239 (WRC-15)

*invites ITU-R*

to conduct and complete the following in time for WRC-19:

- a) to study WAS/RLAN technical characteristics and operational requirements in the 5 GHz frequency range;
- b) to conduct studies with a view to identify potential WAS/RLAN **mitigation techniques to facilitate sharing with incumbent systems in the frequency bands 5 150-5 350 MHz, 5 350-5 470 MHz, 5 725-5 850 MHz and 5 850-5 925 MHz**, while ensuring the protection of incumbent services including their current and planned use;
- c) to perform sharing and compatibility studies between WAS/RLAN applications and incumbent services in the **frequency band 5 150-5 350 MHz with the possibility of enabling outdoor WAS/RLAN operations including possible associated conditions**;
- d) to conduct further sharing and compatibility studies between WAS/RLAN applications and incumbent services addressing:
  - i) whether any **additional mitigation techniques in the frequency band 5 350-5 470 MHz** beyond those analysed in the studies referred to in *recognizing a)* would provide coexistence between WAS/RLAN systems and EESS (active) and SRS (active) systems;
  - ii) **whether any mitigation techniques in the frequency band 5 350-5 470 MHz would provide compatibility between WAS/RLAN systems and radio determination systems**;
  - iii) whether the results of studies under points i) and ii) would enable an allocation of the frequency band 5 350-5 470 MHz to the mobile service with a view to accommodating WAS/RLAN use;
- e) to also conduct detailed sharing and compatibility studies, including mitigation techniques, between WAS/RLAN and incumbent services in the frequency band 5 725- 5 850 MHz with a view to enabling a mobile service allocation to accommodate WAS/RLAN use;
- f) to also conduct detailed sharing and compatibility studies, including mitigation techniques, between WAS/RLAN and incumbent services in the frequency band 5 850-5 925 MHz with a view to accommodating WAS/RLAN use under the existing primary mobile service allocation while not imposing any additional constraints on the existing services,

*invites administrations*

to participate in the studies by submitting contributions to ITU-R.



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## RESOLUTION 764 (WRC-15)

### Consideration of the technical and regulatory impacts of referencing Recommendations ITU-R M.1638-1 and ITU-R M.1849-1 in Nos. 5.447F and 5.450A of the Radio Regulations

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a) that the frequency bands 5 250-5 350 MHz and 5 470-5 725 MHz are allocated worldwide on a primary basis to the radiolocation service;
- b) that WRC-03 allocated the frequency bands 5 150-5 350 MHz and 5 470-5 725 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS) including radio local area networks (RLANs);
- c) that Resolution [229 \(Rev.WRC-12\)](#) defines the conditions for the use of the frequency bands 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz by the mobile service for the implementation of WAS including RLANs while protecting existing primary services;
- d) that No [5.447F](#) states that in the frequency band 5 250-5 350 MHz, stations in the mobile service shall not claim protection from the radiolocation service, the Earth exploration-satellite service (active) and the space research service (active) and that these services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendations ITU-R M.1638-0 and ITU-R RS.1632-0;
- e) that No [5.450A](#) states that in the frequency band 5 470-5 725 MHz, **stations in the mobile service shall not claim protection from radiodetermination services and that radiodetermination services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendation ITU-R M.1638-0,**



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## RESOLUTION 764 (WRC-15)

*noting*

- a) that **Recommendation ITU-R M.1638-0** identifies the characteristics of, and protection criteria for sharing studies for, **radiolocation, aeronautical radionavigation and meteorological radars** operating in the frequency range 5 250-5 850 MHz;
- b) that Recommendation ITU-R M.1638-1 identifies the characteristics of, and protection criteria for sharing studies for, **radiolocation (except ground-based meteorological radars)** and aeronautical radionavigation radars operating in the frequency bands between 5 250 and 5 850 MHz and that Recommendation ITU-R M.1849-1 identifies the technical and operational aspects of ground-based meteorological radars;
- c) that Recommendation ITU-R M.1638-1 includes additional new radar characteristics not included in Recommendation ITU-R M.1638-0,

*further noting*

that, according to Annex 1 to Resolution **27 (Rev.WRC-12)**, the reference of material which is incorporated by reference on a mandatory basis must be explicit, specifying the specific part of the text, if appropriate,

*resolves to invite the ITU Radiocommunication Sector*

1 to investigate the technical and regulatory impacts on the services referred to in Nos. [5.447F](#) and [5.450A](#) that would result from referencing Recommendation ITU-R M.1638-1 in place of Recommendation ITU-R M.1638-0 in those footnotes, while ensuring that no undue constraints are imposed on the services referenced in these footnotes;

2 to investigate the technical and regulatory impacts on the services referred to in Nos [5.447F](#) and [5.450A](#) that would result from **adding a new reference to Recommendation ITU-R M.1849-1 to these footnotes, while ensuring that no undue constraints are imposed on the services referenced in these footnotes,**

*instructs the Director of the Radiocommunication Bureau*

to include the results of these studies in the Director's Report to WRC-19 for consideration of any regulatory action in response to *resolves to invite the ITU Radiocommunication Sector* above.



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## RESOLUTION 958 (WRC-15)

### ANNEX TO RESOLUTION 958 (WRC-15)

#### **Urgent studies required in preparation for the 2019 World Radiocommunication Conference**

- 1) Studies concerning Wireless Power Transmission (WPT) for electric vehicles:
  - a) to assess the impact of WPT for electric vehicles on radiocommunication services;
  - b) to study suitable harmonized frequency ranges which would minimize the impact on radiocommunication services from WPT for electrical vehicles.

These studies should take into account that the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO) and the Society of Automotive Engineers (SAE) are in the process of approving standards intended for global and regional harmonization of WPT technologies for electric vehicles.

## RESOLUTION 162 (WRC-15)

### Studies relating to spectrum needs and possible allocation of the frequency band 51.4-52.4 GHz to the fixed-satellite service (Earth-to-space)

The World Radiocommunication Conference (Geneva, 2015),  
*considering*

- a) that satellite systems are increasingly being used to deliver broadband services and can help enable universal broadband access;
- b) that next-generation fixed-satellite service technologies for broadband will increase speeds (45 Mbps is already available), with faster rates expected in the near future;
- c) that technological developments such as advances in spot-beam technologies and frequency reuse are used by the fixed-satellite service in spectrum above 30 GHz to increase the efficient use of spectrum;
- d) that fixed-satellite applications in spectrum above 30 GHz, such as feeder links, should be easier to share with other radiocommunication services than high-density fixed-satellite service (HDFSS) applications,

*recognizing*

- a) the need to protect existing services when considering frequency bands for possible additional allocations to any service;
- b) that the frequency band 51.4-52.4 GHz is allocated to fixed and mobile services, which will need to be protected, and is available for high-density applications in the fixed service as indicated in No. [5.547](#);
- c) that No. [5.556](#) indicates that radio astronomy observations are carried out in the frequency band 51.4-54.25 GHz and that appropriate measures may have to be defined to protect radio astronomy service,

## RESOLUTION 162 (WRC-15)

*resolves to invite ITU-R*

to conduct, and complete in time for WRC-19:

- 1 studies considering additional spectrum needs for development of the fixed-satellite service, taking into account the frequency bands currently allocated to the fixed-satellite service, the technical conditions of their use, and the possibility of optimizing the use of these frequency bands with a view to increasing spectrum efficiency;
- 2 subject to justification resulting from studies conducted under *resolves to invite ITU-R 1*, sharing and compatibility studies with existing services, on a primary and secondary basis, **including in adjacent bands** as appropriate, to determine the suitability, including protection of fixed and mobile services, of new primary allocations to the FSS in the frequency band 51.4-52.4 GHz (Earth-to-space) limited to FSS feeder links for geostationary orbit use, and the possible associated regulatory actions;
- 3 **studies towards possible revision of Resolution [750 \(Rev.WRC-15\)](#) so that systems operating in the passive frequency band 52.6-54.25 GHz are protected;**
- 4 studies regarding the protection of radio astronomy, as described in *recognizing c)*, including regulatory measures, as appropriate,

*instructs the Director of the Radiocommunication Bureau*

to report on the results of the ITU-R studies to WRC-19,

*invites administrations*

to participate actively in these studies by submitting contributions to ITU-R.