



IAF-20 Spring meeting – remote presentation  
27.03.2020



# **WRC-19**

## **Outcome and Challenges**

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**3 420** participants attended WRC-19

- 3160 delegates from 163 Member States (*of 193 ITU member states*)
- 260 observers - ITU-R sector members (*operators, industry, R&D*)

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<https://www.itu.int/go/wrc-19>

# The WRC Purpose

✓ Updates the ITU Radio Regulations (RR) – new version as of 1.1.2021

❖ *Legal bindings doc - **treaty** status*

• *Incorporates the WRC decisions*



• **4 Volumes** (Articles/Appendices/Resolutions/ITU-R Rec inc.ref.)

• Table of Frequency Allocations (FAT & Radio Services) (ART 5)

• Coordination (ART9) and Notification (ART11), Space Plans (AP30/30A&AP 30B)

• Interference and Administrative provisions (Licensing, Identification)

• Provisions for services and stations (Terrestrial/Space sharing (pfd, epfd))

• Aero and Maritime services

✓ Adopts Resolutions and Recommendations

✓ Held every ~4 years – next one **WRC-23**



# WRC-19 *key facts*

- ✓ **17** *Specific* Agenda Items (AI) and **6** *standing* AI
- ✓ **568** contributions and documents treated by the WRC-19
- ✓ *Paperless* World conference in **6** Languages (E/F/S/A/C/R)

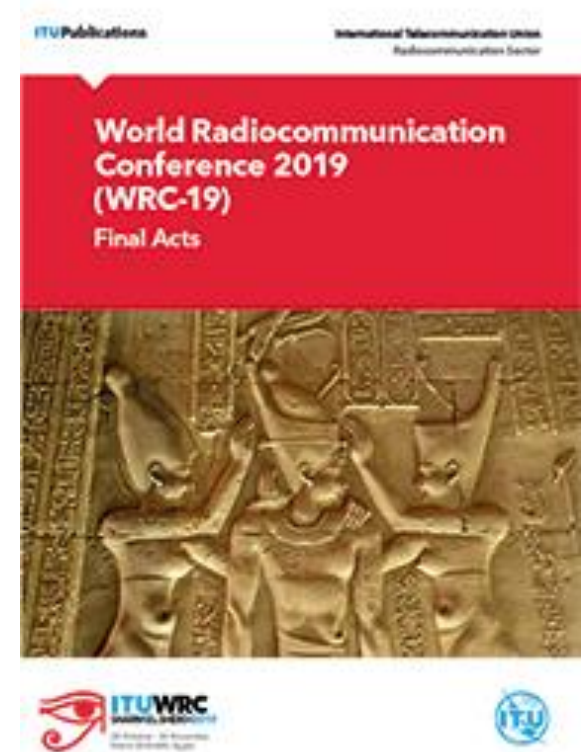
❖ WRC-19 Final Acts (FA) signed on **22.11.2019**

- *WRC-19 Resolutions enters into force at the time of the signing of the FA WRC-19*

❖ *Updated RR shall enter into force on* **01.01.2021**

- For **exceptions** see *FA WRC-19 – ART 59 and RES-99*

<https://www.itu.int/go/wrc-19>



# WRC-19 Agenda Items 1

<b>1</b>	on the basis of proposals from administrations, taking account of the results of WRC-15 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the frequency bands under consideration, to consider and take appropriate action in respect of the following items:
<b>1.1</b>	to consider an allocation of the frequency band 50-54 MHz to the amateur service in Region 1, in accordance with Resolution 658 (WRC-15);
<b>1.2</b>	to consider in-band power limits for earth stations operating in the mobile-satellite service, meteorological-satellite service and Earth exploration-satellite service in the frequency bands 401-403 MHz and 399.9-400.05 MHz, in accordance with Resolution 765 (WRC-15);
<b>1.3</b>	to consider possible upgrading of the secondary allocation to the meteorological-satellite service (space-to-Earth) to primary status and a possible primary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band 460-470 MHz, in accordance with Resolution 766 (WRC-15);
<b>1.4</b>	to consider the results of studies in accordance with Resolution 557 (WRC-15), and review, and revise if necessary, the limitations mentioned in Annex 7 to Appendix 30 (Rev.WRC-15), while ensuring the protection of, and without imposing additional constraints on, assignments in the Plan and the List and the future development of the broadcasting-satellite service within the Plan, and existing and planned fixed-satellite service networks;
<b>1.5</b>	to consider the use of the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) by earth stations in motion communicating with geostationary space stations in the fixed-satellite service and take appropriate action, in accordance with Resolution 158 (WRC-15);
<b>1.6</b>	to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5-39.5 GHz (space-to-Earth), 39.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), in accordance with Resolution 159 (WRC-15);
<b>1.7</b>	to study the spectrum needs for telemetry, tracking and command in the space operation service for non-GSO satellites with short duration missions, to assess the suitability of existing allocations to the space operation service and, if necessary, to consider new allocations, in accordance with Resolution 659 (WRC-15);
<b>1.8</b>	to consider possible regulatory actions to support Global Maritime Distress Safety Systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS, in accordance with Resolution 359 (Rev.WRC-15);

# WRC-19 Agenda Items 2

<b>1.9</b>	to consider, based on the results of ITU-R studies:
<b>1.9.1</b>	regulatory actions within the frequency band 156-162.05 MHz for autonomous maritime radio devices to protect the GMDSS and automatic identifications system (AIS), in accordance with Resolution 362 (WRC-15);
<b>1.9.2</b>	modifications of the Radio Regulations, including new spectrum allocations to the maritime mobile-satellite service (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125-157.4375 MHz and 160.6125-162.0375 MHz of Appendix 18, to enable a new VHF data exchange system (VDES) satellite component, while ensuring that this component will not degrade the current terrestrial VDES components, applications specific messages (ASM) and AIS operations and not impose any additional constraints on existing services in these and adjacent frequency bands as stated in recognizing d) and e) of Resolution 360 (Rev.WRC-15);
<b>1.10</b>	to consider spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System (GADSS), in accordance with Resolution 426 (WRC-15);
<b>1.11</b>	to take necessary actions, as appropriate, to facilitate global or regional harmonized frequency bands to support railway radiocommunication systems between train and trackside within existing mobile service allocations, in accordance with Resolution 236 (WRC-15);
<b>1.12</b>	to consider possible global or regional harmonized frequency bands, to the maximum extent possible, for the implementation of evolving Intelligent Transport Systems (ITS) under existing mobile-service allocations, in accordance with Resolution 237 (WRC-15);
<b>1.13</b>	to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC-15);
<b>1.14</b>	to consider, on the basis of ITU-R studies in accordance with Resolution 160 (WRC-15), appropriate regulatory actions for high-altitude platform stations (HAPS), within existing fixed-service allocations;
<b>1.15</b>	to consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275-450 GHz, in accordance with Resolution 767 (WRC-15);
<b>1.16</b>	to consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz, and take the appropriate regulatory actions, including additional spectrum allocations to the mobile service, in accordance with Resolution 239 (WRC-15);

## WRC-19 Agenda Items 3

2	to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with Resolution 28 (Rev.WRC-15), and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in Annex 1 to Resolution 27 (Rev.WRC-12);
3	to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;
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;
5	to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the Convention;
6	to identify those items requiring urgent action by the radiocommunication study groups in preparation for the next world radiocommunication conference;
7	to consider possible changes, and other options, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, an advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution 86 (Rev.WRC-07), in order to facilitate rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;
8	to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution 26 (Rev.WRC-07);

# WRC-19 Agenda Items 4

9	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-15;
	9.1.1-Res. 212 (Rev.WRC-15) – Implementation of International Mobile Telecommunications in the frequency bands 1 885-2 025 MHz and 2 110-2 200 MHz
	9.1.2-Res. 761 (-15) – Compatibility of International Mobile Telecommunications and broadcasting-satellite service (sound) in the frequency band 1 452-1 492 MHz in Regions 1 and 3
	9.1.3-Res. 157 (WRC-15) – Study of technical and operational issues and regulatory provisions for new non-geostationary-satellite orbit systems in the 3 700-4 200 MHz, 4 500-4 800 MHz, 5 925-6 425 MHz and 6 725-7 025 MHz frequency bands allocated to the fixed-satellite service
	9.1.4-Res. 763 (WRC-15) – Stations on board sub-orbital vehicles
9.1	9.1.5-Res. 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
	9.1.6 -Issue 1) in the 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.
	9.1.7-Issue 2) in the Annex to Resolution 958 (WRC-15) – Urgent studies required in preparation for the 2019 World Radiocommunication Conference
	2) Studies to examine:
	a) whether there is a need for possible additional measures in order to limit uplink transmissions of terminals to those authorized terminals in accordance with No. 18.1;
	b) the possible methods that will assist administrations in managing the unauthorized operation of earth station terminals deployed within its territory, as a tool to guide their national spectrum management programme, in accordance with Resolution ITU-R 64 (RA 15).
	9.1.8-Issue 3) in the Annex to Resolution 958 (WRC-15) – Urgent studies required in preparation for the 2019 World Radiocommunication Conference
	3) Studies on the technical and operational aspects of radio networks and systems, as well as spectrum needed, including possible harmonized use of spectrum to support the implementation of narrowband and broadband machine-type communication infrastructures, in order to develop Recommendations, Reports and/or Handbooks, as appropriate, and to take appropriate actions within the ITU Radiocommunication Sector (ITU-R) scope of work.
	9.1.9-Res. 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)
9.2	on any difficulties or inconsistencies encountered in the application of the Radio Regulations and
9.3	on action in response to Resolution 80 (Rev.WRC-07);
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



# Amateur issues **WRC-19 AI 1.1**



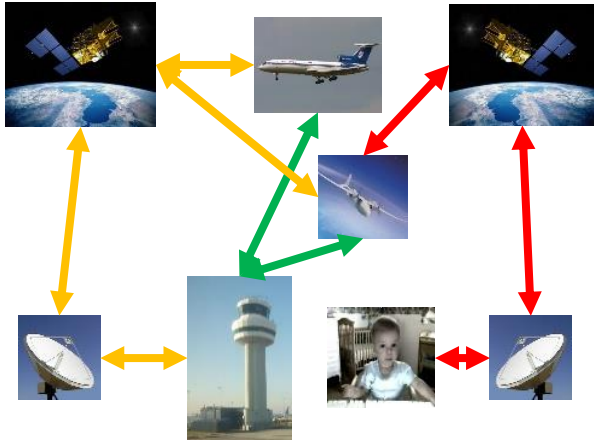
- **AI-1.1 RES-658 (WRC-15)**  
Studies for consideration of an allocation of the band **50-54 MHz** to the **amateur service** in **Region 1** (*towards a worldwide allocation for harmonized weak signal communications*)

## **WRC-19 AI 1.1 – ARS – 50 MHz Decision**

**WRC-19 decision:** the band 50-52 MHz is approved as *secondary allocation* to the amateur service in Region 1 (**R1**) and **PRIMARY allocation** for administrations in footnote **5.164**

**NOC** to **AMATEUR 50-54 MHz** in **R2+R3** and footnotes 5.162A 5.167 5.167A 5.168 5.170

# Aeronautical issues WRC-19 AI 1.10



- **AI-1.10 RES-426 (WRC-15)**  
Studies to consider **spectrum needs & regulatory provisions** for introduction and use of the **GADSS** (*Global Aeronautical Distress and Safety System*)

## WRC-19 AI 1.10 – GADSS Decision

### WRC-19 decision:

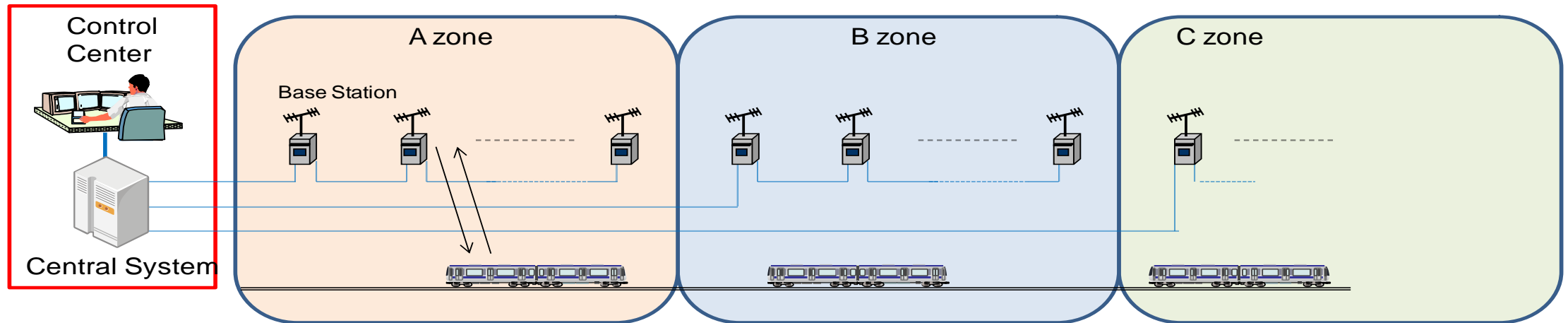
- ✓ **NOC** on the Agenda Item **1.10**
- ✓ **SUP RES-426** (WRC-15) Studies on spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System

# New transport systems in the MS **WRC-19 AI 1.11**



- **AI-1.11 RES-236 (WRC-15)**

Studies to take necessary actions, as appropriate, to facilitate **global or regional harmonized bands to support railway radiocommunication systems** between train & trackside within existing MS allocations



On-board antenna



Base station antenna

# WRC-19 AI 1.11 – RSTT Decision

## WRC-19 decision:

- ✓ RES-**240** (WRC-19) Spectrum harmonization for railway radiocommunication systems between train and trackside (**RSTT**) within the existing mobile service allocation

### *resolves*

to encourage administrations, when planning for their RSTT, to consider the study results as per *invites ITU-R 1*, as well as other relevant ITU-R Recommendations/Reports (ITU-R M.2418 & ITU-R M.2442), with a view to facilitating spectrum harmonization for railway radiocommunication systems between train and trackside” (RSTT), in particular for train radio applications

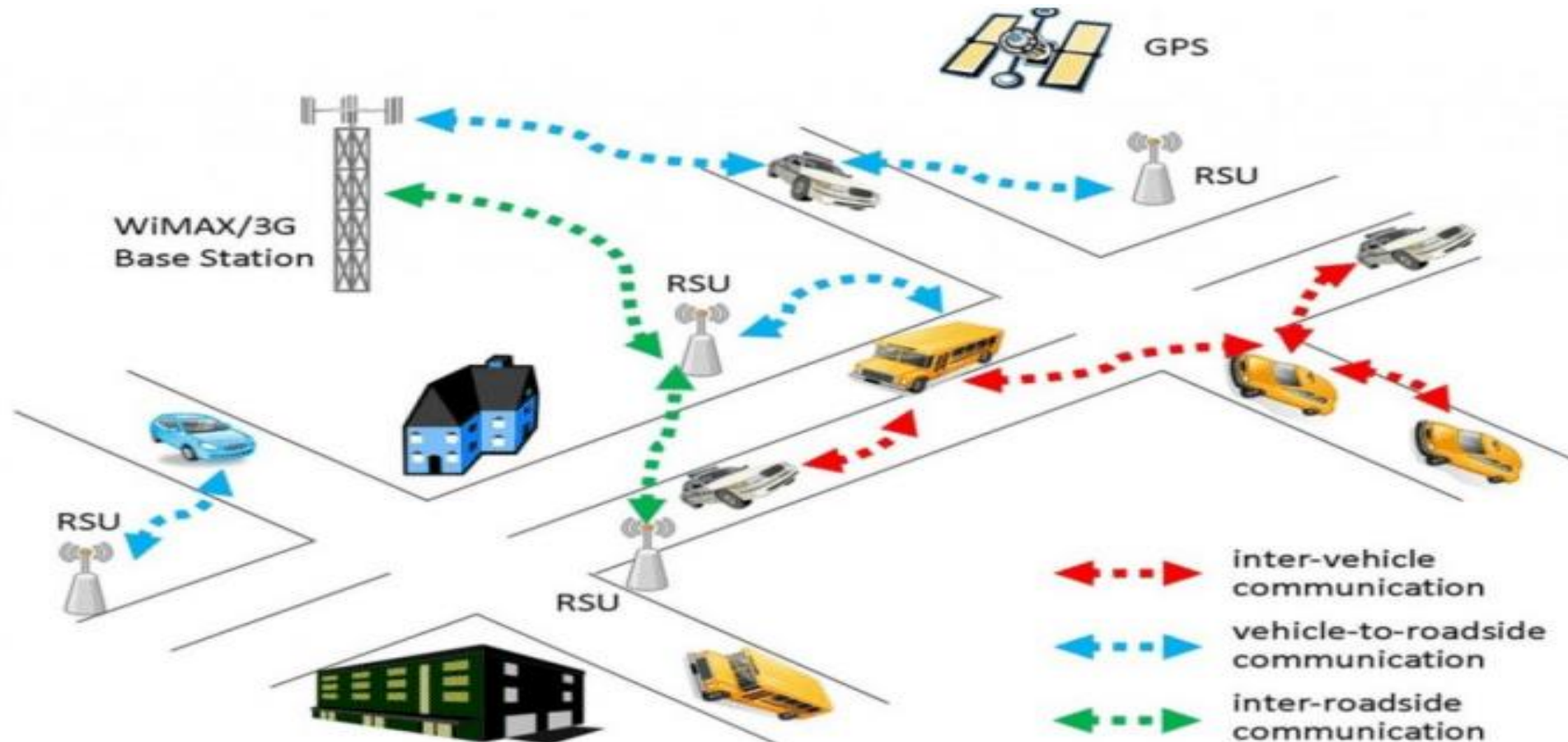


# New transport systems in the MS **WRC-19 AI 1.12**



- **AI-1.12 RES-237 (WRC-15)**

Studies to consider possible **global or regional harmonized bands**, to the maximum extent possible, for **implementation of evolving ITS** (*Intelligent Transport systems*) within existing MS allocations



# WRC-19 AI 1.12 – ITS Decision

## WRC-19 decision:

- ✓ RECOMMENDATION **208** (WRC-19) - Harmonization of frequency bands for evolving Intelligent Transport Systems (**ITS**) applications under mobile-service allocations

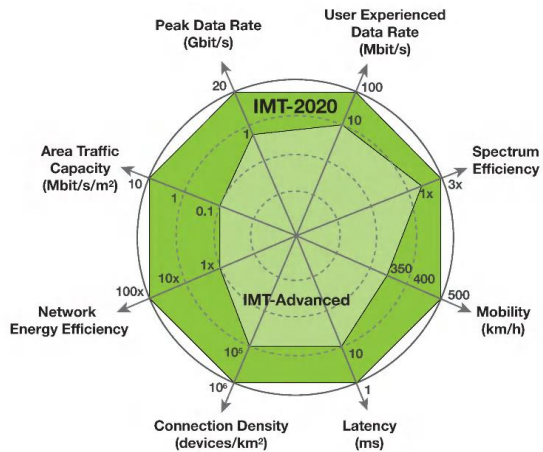
### *Recommends*

- 1) that administrations consider using globally or regionally harmonized frequency bands, or parts thereof, as described in the most recent versions of Recommendations (e.g. ITU-R M.2121), when planning and deploying evolving ITS applications, taking into account recognizing b);
- 2) that administrations take into account, if necessary, coexistence issues between ITS stations and stations of existing services (e.g. FSS ES)

- **AI-1.13 RES-238 (WRC-15)**

The following bands, which are already allocated to mobile, with a view to an **IMT-2020 identification**

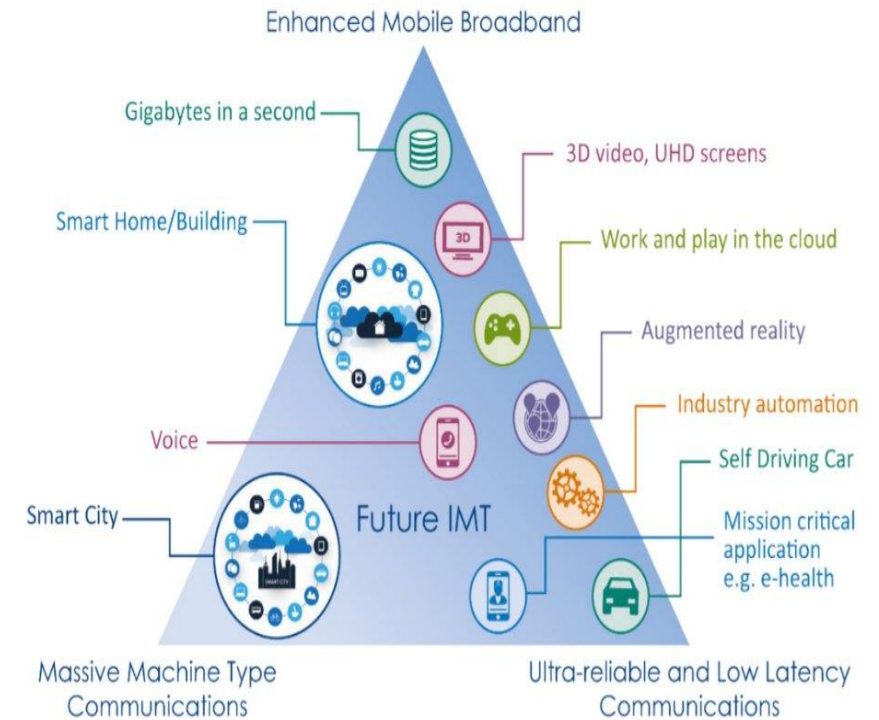
- 24.25 – 27.5, **37.0 – 40.5 GHz**
- **42.50 – 43.5, 45.5 – 47.0 GHz**
- **47.20 – 50.2, 50.4 – 52.6 GHz**
- 66 – 76 GHz    81 – 86 GHz



## Introduction of new IMT applications

- enhanced Mobile BroadBand (**eMBB**)
- massive Machine-Type Communications (**mMTC**)
- Ultra Reliable and Low-Latency Communications (**URLLC**)

5G usage scenarios



# WRC-19 AI 1.13 – IMT-2020 Decision

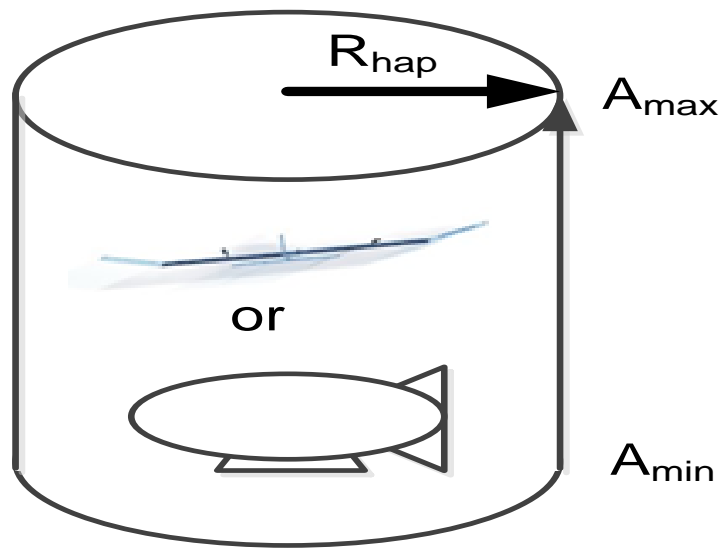
WRC-19 decision - **10 times** increase of IMT bands compared to WRC-15 (current RR):

- ✓ Agreed on **Global IMT** identification and conditions for the bands 24.25-27.5, 37-43.5 and 66-71 GHz = **14.75 GHz**
- ✓ Agreed on **Restricted (regional)** IMT identification and conditions for the bands 45.5-47.0 and 47.2-48.2 GHz = **2.5 GHz**
- ✓ **NOC** for the candidate bands 31.8 - 33.4, 47 - 47.2, 48.2 - 50.2, 50.4 - 52.6, 71 - 76 and 81 - 86 GHz

WRC-19 IMT <i>identification</i> (GHz)	RR Regions	BW (GHz)	Remarks
24.25-27.5	<b>GLOBAL</b> (No. <b>5.532AB</b> )	<b>3.25</b>	RES- <b>242</b>
31.8-33.4	<b>NOC</b>		
37-43.5	<b>GLOBAL</b> (No. <b>5.550B</b> )	<b>6.5</b>	RES- <b>243</b>
45.5-47.0	No. <b>5.553A</b>	<b>1.5</b>	RES- <b>244</b>
47.0-47.2	<b>NOC</b>		
47.2-48.2	No. <b>5.553B</b>	<b>1.0</b>	RES- <b>243</b>
48.2-50.2	<b>NOC</b>		
50.4-52.6	<b>NOC</b>		
66-71	<b>GLOBAL</b> (No. <b>5.559AA</b> )	<b>5.0</b>	RES- <b>241</b>
71-76	<b>NOC</b>		
81-86	<b>NOC</b>		

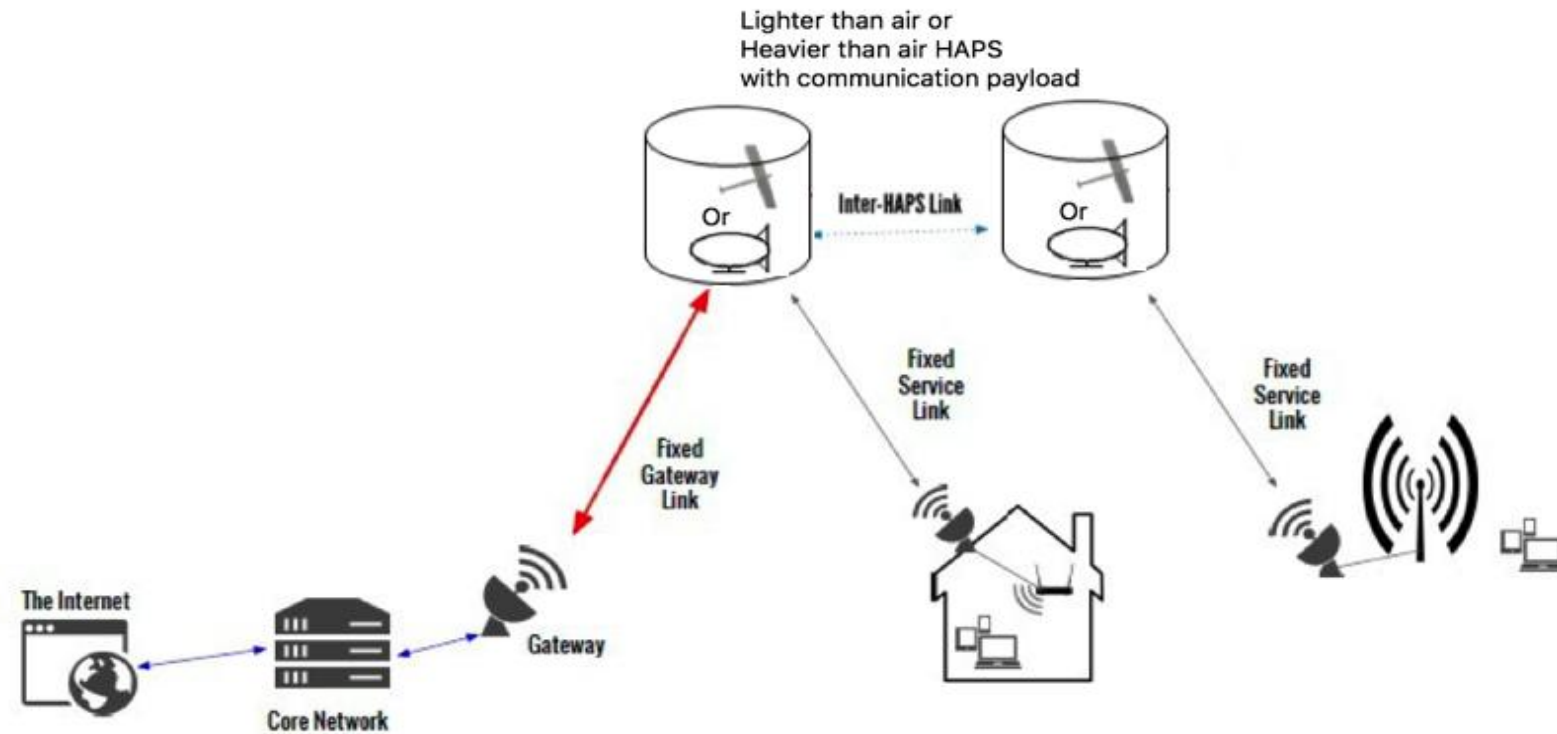


# FS Systems/**HAPS** - WRC-19 Agenda Item 1.14



- **AI-1.14 RES-160 (WRC-15)**

Studies for considering appropriate regulatory actions for **High-Altitude Platform Stations (HAPS)**, within existing FS allocations or study new bands: [21.4-22](#) & [24.25-27.5](#) and [38-39.5 GHz](#)



- **HAPS** platform shall remain at a “specified, nominal, fixed point” and may change altitude over time within a “regulatory bounded cylindrical volume upper and lower limits” (RR No. 1.66A)

# WRC-19 AI 1.14 – HAPS Decision

## WRC-19 decision:

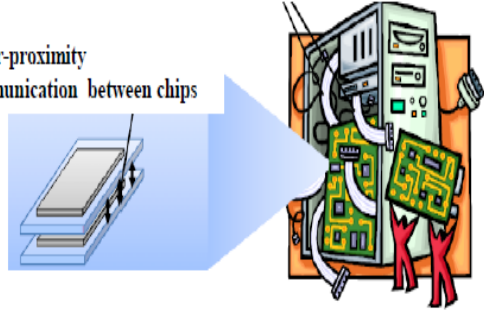
- ✓ Agreed on **Global HAPS *identification*** and conditions (RES) for the bands 31-31.3 & 38-39.5 GHz
- ✓ Agreed on **Restricted (regional)** identification and conditions (RES) for the bands 21.4-22, 24.25 & 25.25-27.4 GHz
- ✓ **NOC** for the bands 6 440 - 6 520 / 6 560 - 6 640 MHz (No.5.547)

WRC-19 HAPS <i>identification</i> (GHz)	RR Regions	BW (MHz)	Remarks
6 440-6 520 MHz	<b>NOC</b>	<b>80</b>	No.5.547
6 560-6 640 MHz	<b>NOC</b>	<b>80</b>	No.5.547
21.4-22 (HAPS-ground)	<b>R2</b> (No. 5.530E)	<b>600</b>	RES <b>165</b>
24.25-25.25	<b>R2</b> (No. 5.532AA)	<b>1 000</b>	RES <b>166</b>
25.25-27.5	<b>R2</b> (No. 5.534A)	<b>2 250</b>	RES <b>166</b>
27.9-28.2	<b>MOD</b>	<b>300</b>	No.5.537A/RES-145
31-31.3	<b>GLOBAL</b> (No. 5.543B)	<b>300</b>	SUP No.5.343A RES <b>167</b>
38-39.5	<b>GLOBAL</b> (No. 5.550D)	<b>1 500</b>	RES <b>168</b>
47.2-47.5	<b>NOC GLOBAL</b> (No. 5.552A)	<b>300</b>	No.5.552A/RES-122
47.9.-48.2	<b>NOC GLOBAL</b> (No. 5.552A)	<b>300</b>	No.5.552A/RES-122

- ✓ RES-165 (WRC-19) Use of the frequency band 21.4-22.0 GHz by HAPS in FS in Region 2
- ✓ RES-166 (WRC-19) Use of the frequency band 24.25-27.5 GHz by HAPS in FS in Region 2
- ✓ RES-167 (WRC-19) Use of the frequency band 31-31.3 GHz by HAPS in FS
- ✓ RES-168 (WRC-19) Use of the frequency band 38-39.5 GHz by HAPS in FS
- ✓ RES-145 (WRC-19) Use of the frequency band 27.9-28.2 GHz by HAPS in FS

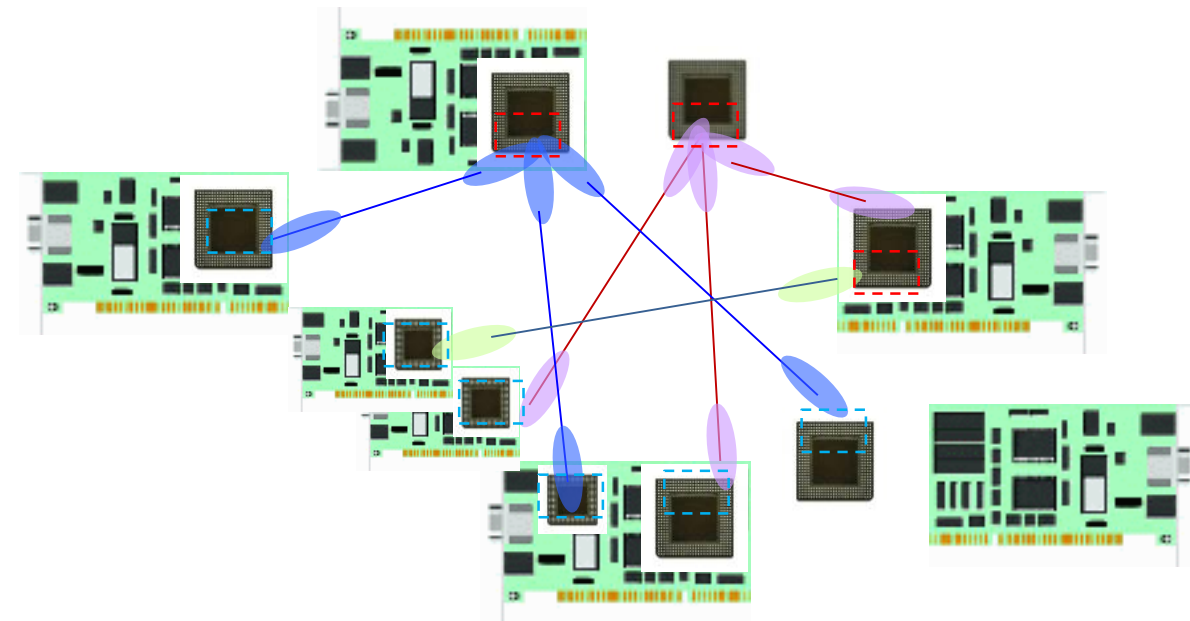
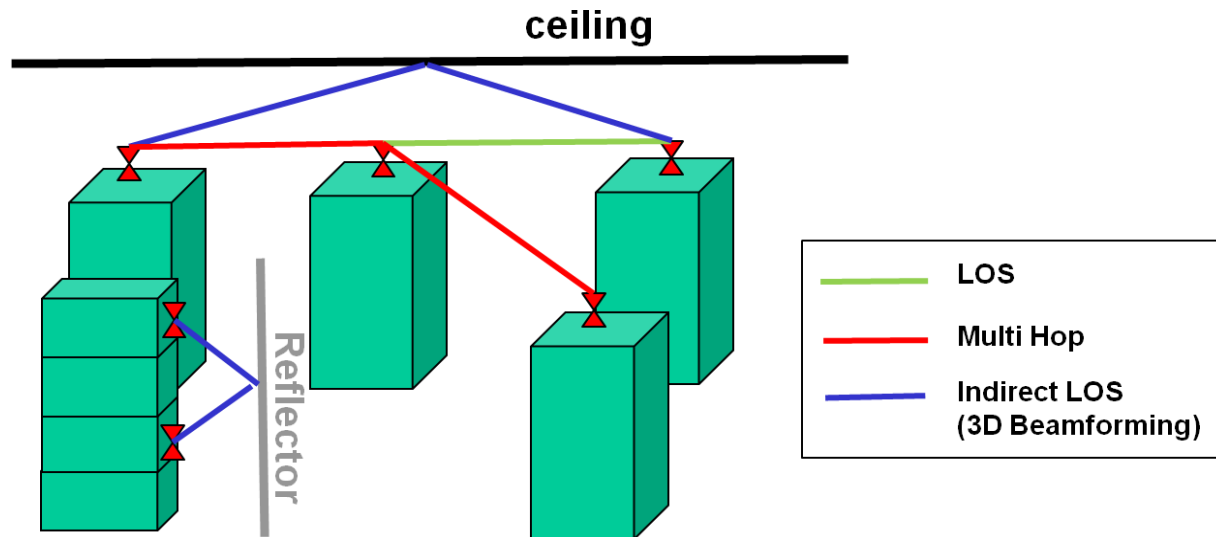
Super-proximity communication between circuit board

Super-proximity communication between chips



- **AI-1.15 RES-767 (WRC-15)**

Studies towards an **identification** for use by **LMS and FS applications** operating in the frequency range **275-450 GHz**



# WRC-19 AI 1.15 – LMS/FS Decision

## WRC-19 decision:

### ✓ ADD RR No. 5. X115

Operation of **L**and **M**obile and **F**ixed **S**ervice applications in frequency bands in the range 275-450 GHz:

- ❖ The frequency bands 275-296 GHz, 306-313 GHz, 318-333 GHz and 356-450 GHz are identified for use by administrations for the implementation of land mobile and fixed service applications, where no specific conditions are necessary *to protect Earth exploration-satellite service (passive)* applications.
- The frequency bands 296-306 GHz, 313-318 GHz and 333-356 GHz *may only be used by fixed and land mobile service* applications when specific conditions *to ensure the protection of Earth exploration-satellite service (passive)* applications are determined in accordance with RES-**731** (Rev.WRC-19)
- In those portions of the frequency range 275-450 GHz where radio astronomy applications are used, specific conditions (e.g. minimum separation distances and/or avoidance angles) may be necessary *to ensure protection of radio astronomy sites* from land mobile and/or fixed service applications, on a case-by-case basis in accordance with RES-**731** (Rev.WRC-19).
- ❖ The use of the above-mentioned frequency bands by land mobile and fixed service applications does not preclude use by, and does not establish priority over, any other applications of radio services in the range of 275-450 GHz

See [REPORT ITU-R M.2417](#)



# MS Broadband WRC-19 Agenda Item 1.16



- **AI-1.16 RES-239 (WRC-15)**











Appropriate regulatory actions, incl. additional MS allocations, for **WAS/RLAN** in the bands between **5 150-5 925 MHz**

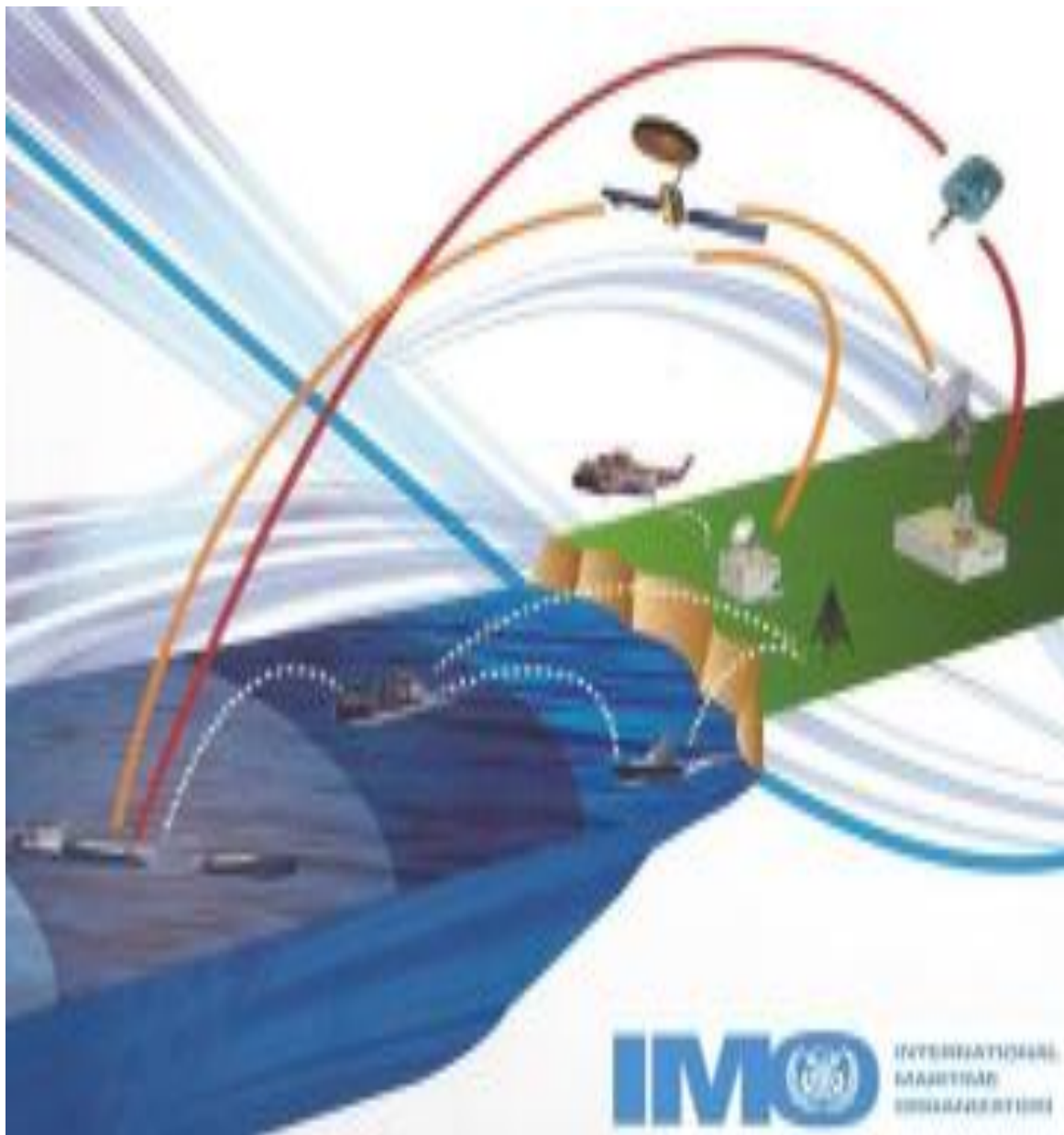
## WRC-19 AI 1.16 – **WAS/RLAN** Decision

### WRC-19 decision:

- ✓ **NOC** to frequency bands 5 250-5 350, 5 350-5 470, 5 725-5 850 and 5 850-5 925 MHz
  - ✓ MOD RES **229** - Use of the frequency bands 5 150-5 250, 5 250-5 350 and 5 470-5 725 MHz by the MS for the implementation of wireless access systems including radio local area networks (WAS/RLAN)
- resolves*
- the use of the mobile service for the implementation of WAS, including RLANs, as described in the most recent version of ITU-R M.1450
  - in the band 5 150-5 250 MHz, stations in the mobile service shall be restricted to *indoor use, including inside trains*, with a **max e.i.r.p. of 200 mW** and a max e.i.r.p. density of 10 mW/MHz in any 1 MHz band or equivalently 0.25 mW/25 kHz in any 25 kHz band
  - Mobile stations *inside automobiles* shall operate with a **max e.i.r.p. of 40 mW**
  - ❖ in the frequency band 5 150-5 250 MHz, administrations *may exercise some flexibility* by taking appropriate measures that would allow *controlled and/or limited outdoor usage* with a **max e.i.r.p. of 200 mW**. Administrations have a further option to permit stations in the mobile service, *for indoor or controlled outdoor use*, to operate up to a **max e.i.r.p of 30 dBm (1W)**

# Most important topics - WRC-19 AI with *impact on space services*

AI / Topic		AI / Topic	
	<b>1.13)</b> Future development of <b>IMT2020</b> $24.25 < \text{IMT} < 86 \text{ GHz}$ <b>RES-238</b>		<b>1.8)</b> <b>GMDSS &amp; MMSS</b> - L band (s-E) <b>RES-359</b>
	<b>1.14)</b> High-altitude platform stations ( <b>HAPS</b> ) <b>RES-160</b>		<b>1.9.2)</b> <b>MMSS</b> (E-s & s-E) <b>VDES</b> <b>RES-360</b>
	<b>1.2)</b> <b>EIRP</b> for <b>ES MSS</b> , <b>EESS</b> , <b>MetSS</b> $401\text{-}403\&399.9\text{-}400.05 \text{ MHz}$ (E-s) <b>RES-765</b>		<b>1.5)</b> <b>GSO FSS</b> <b>ESIM</b> in <b>Ka</b> bands <b>RES-158</b>
	<b>1.3)</b> <b>MetSS</b> , <b>EESS</b> $460\text{-}470 \text{ MHz}$ (s-E) <b>RES-766</b>		<b>1.6)</b> <b>Non-GSO FSS</b> in <b>Q/V</b> bands <b>RES-159</b>
	<b>1.7)</b> TT&C SOS for <b>n-GSO SDM</b> <b>RES-659</b>		<b>7)</b> Changes / other options on <b>API</b> , <b>CR</b> or <b>Notification</b> procedures <b>RES-86</b>
	<b>9)</b> Report of the Director of the Bureau		<b>10)</b> <b>WRC-23 Agenda</b> and <i>preliminary</i> <b>WRC-27 Agenda</b>



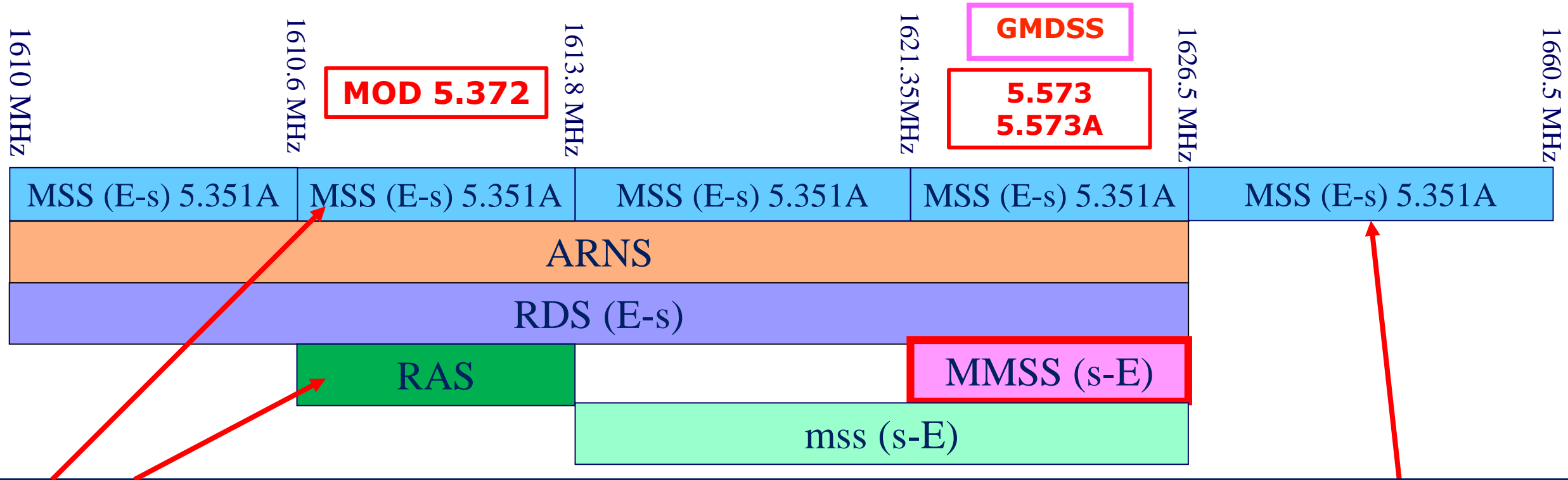
- **AI-1.8 RES-359 (WRC-15)**  
Studies to consider possible **regulatory actions** to support **GMDSS** (Global Maritime Distress and Safety Systems) **modernization** and the introduction of **additional satellite systems** into the GMDSS, **protection** of existing systems

# WRC-19 AI 1.8 – GMDSS satellite Decision

## WRC-19 decision - Applicable as of 23.11.2019

- ✓ Upgrade of the status of band 1 621.35-1 626.5 MHz from a secondary to a primary allocation for the MMSS (s-E). The status of all other allocations in the frequency band 1 613.8-1 626.5 MHz will remain unchanged;
- ✓ MOD No. 5.368 and identification of the band 1 621.35-1 626.5 MHz in RR AP 15 for GMDSS purpose;
- ✓ MOD No. 5.372, in order to make mandatory and quantify the *protection of the RAS*, introducing epfd limits by all space stations of a n-GSO MSS (s-E) operating in frequency band 1 613.8-1 626.5 MHz



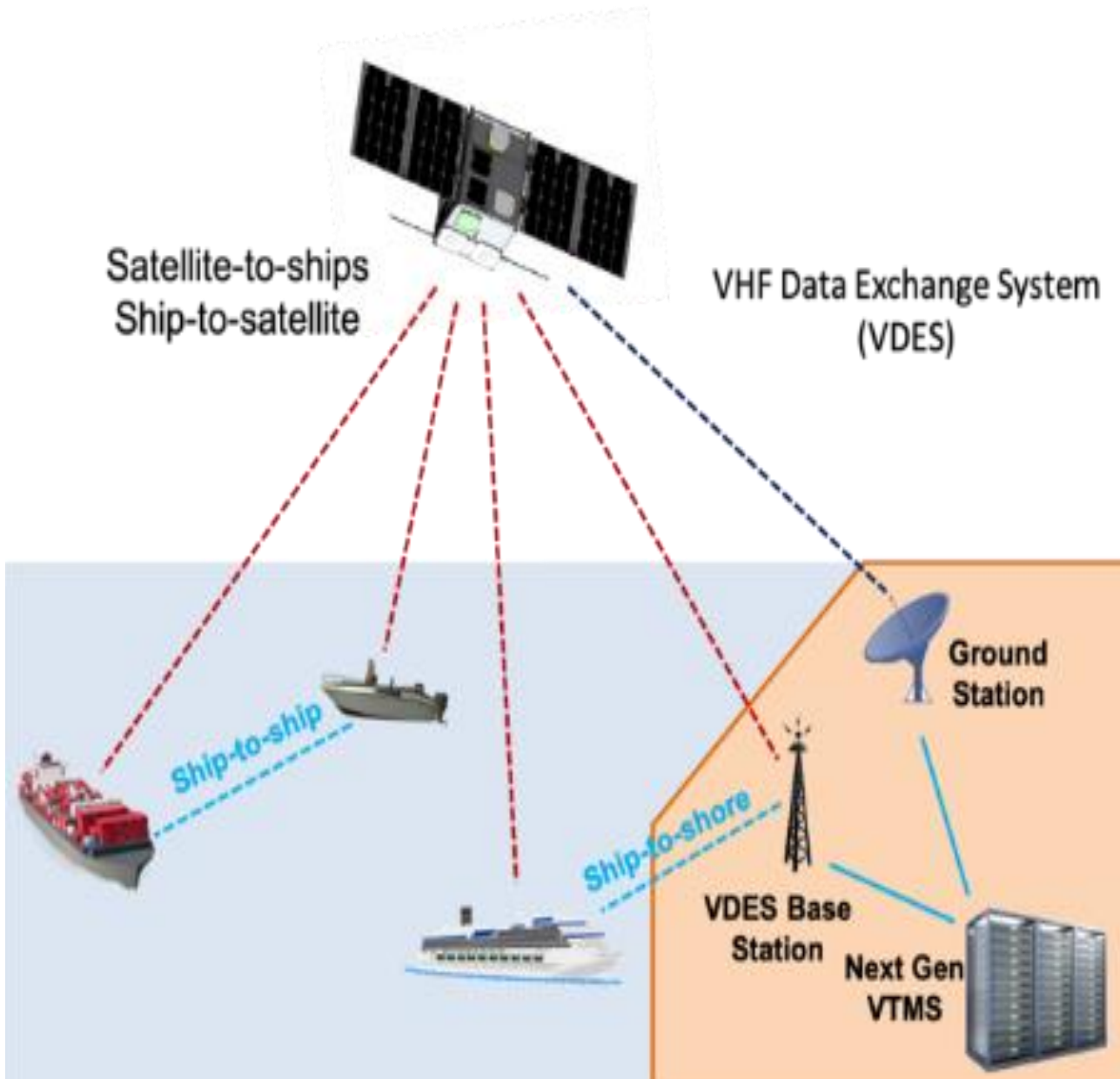


**5.372** Harmful interference shall not be caused to stations of the **RAS** using the band 1 610.6-1 613.8 MHz by stations of the RDS&MSS (No. **29.13** applies). The epfd produced in the band 1 610.6-1 613.8 MHz by all non-GSO MSS (s-E) operating in frequency band 1 613.8-1 626.5 MHz shall be in compliance with the protection criteria provided in ITU-R [RA.769-2](#) and ITU-R [RA.1513-2](#), using the methodology given in ITU-R [M.1583-1](#), and the RAS antenna pattern described in ITU-R [RA.1631-0](#).

**5.573** MM ES in the frequency band 1 621.35-1 626.5 MHz shall not impose additional constraints on MMSS ES RDS MES operating in accordance with the RR in the band 1 610-1 621.35 MHz or MMSS ES operating in accordance with the RR in the frequency band 1 626.5-1 660.5 MHz, unless otherwise agreed between the notifying ADM.

**5.573A** MM ES in the band 1 621.35-1 626.5 MHz shall not impose constraints on the assignments of **MMSS&RDS ES** in the band 1 621.35-1 626.5 MHz *in networks for which complete coordination information has been received by the Bureau before 28 October 2019*.

# Maritime issues WRC-19 Agenda Item 1.9.2



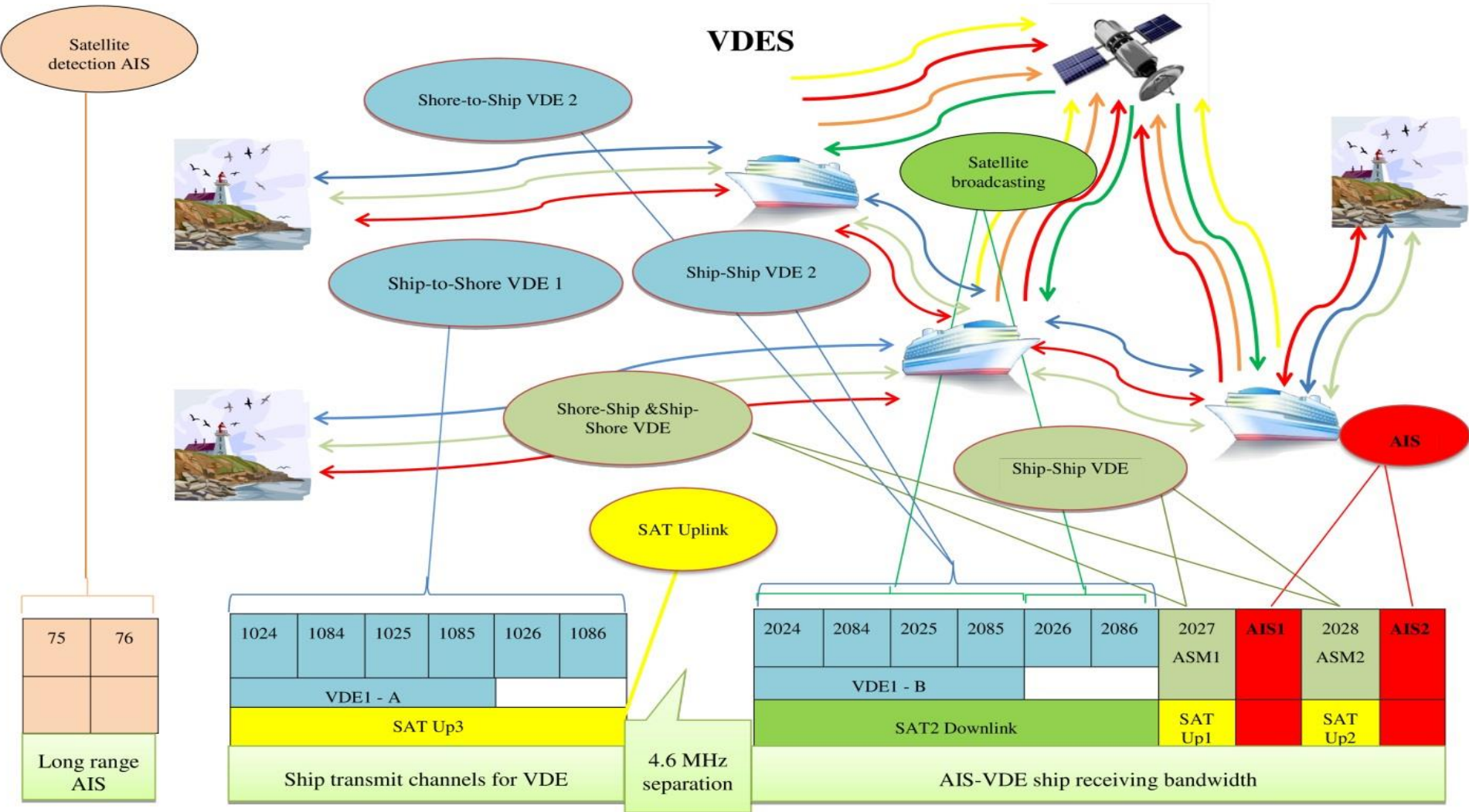
- **AI-1.9.2 RES-360 (WRC-15)** Studies to consider RR MODs, including **new MMSS (E-s & s-E)** allocations, preferably **within 156.0125-157.4375 MHz & 160.6125-162.0375 MHz of RR AP18**, to **enable a new VDES (VHF Data Exchange System) satellite component**

## WRC-19 AI 1.9.2 - VDES Decision 1

### WRC-19 decided:

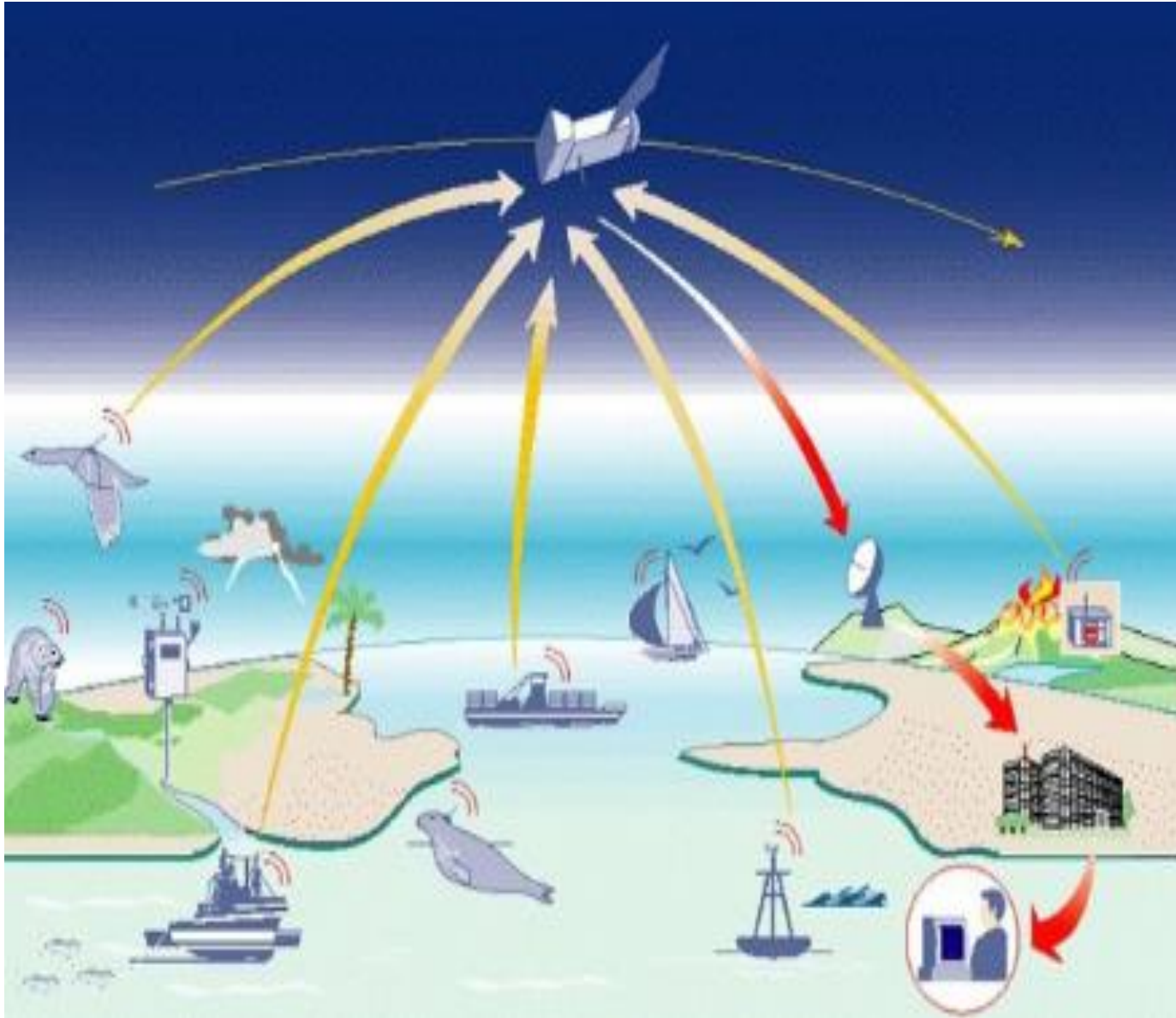
- ✓ to change the RR in order to introduce **VDE-SAT** to support the digital evolution of maritime communications in two frequency bands *157.1875-157.3375 MHz* and *161.7875-161.9375 MHz*. These two frequency bands correspond to Ch. 1024, 1084, 1025, 1085, 1026, 1086 & 2024, 2025, 2085, 2026 and 2086 of AP **18**
- **5.228AB** The use of the frequency bands *157.1875-157.3375 MHz* and *161.7875-161.9375 MHz* (E-s) & (s-E) by the *MMSS* is limited to n-GSO satellite systems operating in accordance with Appendix **18** (see also REC-ITU-R **M.2092**)
- The use of these bands by the MMSS (s-E) is subject to *agreement obtained under No. **9.21*** with respect to the terrestrial services in adm listed in No. **5.228AC**

# WRC-19 AI 1.9.2 - VDES Decision 2





# Space **Science** issues WRC-19 **Agenda Item 1.2**

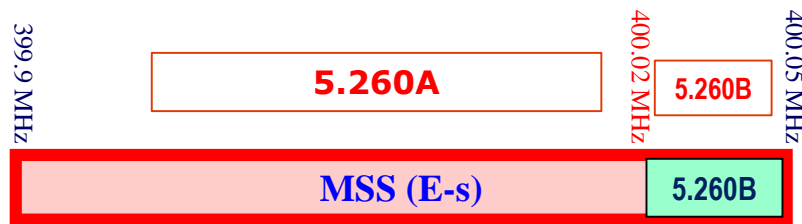


- **AI-1.2 RES-765 (WRC-15)**  
Studies to consider in-band power limits for ES in MetSat and EESS 401-403 MHz (E-s) and in the MSS in 399.9-400.05 MHz (E-s) band in order to be able to provide *long-term continuity* for the operation of low power levels Data Collection Systems(**DCS**) by satellite
- see also [CPM-19-2 Report to WRC-19](#)



# WRC-19 AI 1.2 - DCS Decision

**Applicable as of 23. NOV. 2019**



- **5.260A** In *399.9-400.05 MHz*, the max e.i.r.p. ES MSS shall not exceed **5 dBW**

- *Until 22 NOV 2022* this limit shall not apply to satellite systems for which *complete notification* has been received by the Bureau *by 22 NOV 2019* and that *have been brought into use by that date*
- *After 22 NOV 2022* these limits shall apply to *all ES MSS* in this band
- In the frequency band *399.99-400.02 MHz*, the e.i.r.p. limits as specified above shall apply *after 22 NOV 2022* to **all ES MSS**

- **5.260B** In *400.02-400.05 MHz*, **5.260A** not applicable for ES MSS (E-s) TT&C

## • 5.264A

- *Until 22 NOV 2029* limits shall not apply to satellite systems for which *complete notification* has been received by the Bureau *by 22 NOV 2019* and that *have been brought into use by that date*.
- *After 22 NOV 2029* these limits shall apply to *all ES MetSS and EESS* operating in this frequency band

- **5.264B** Non-GSO MetSS & EESS for which complete notification information has been received by the Bureau *before 28 APR 2007* are exempt from No. **5.264A** and ES may continue to operate in *401.898-402.522 MHz* on a **PRIMARY** basis without exceeding a max e.i.r.p. level of **12 dBW**

401 MHz	<div>5.264A+5.264B</div>		402 MHz	<div>5.264A+5.264B</div>		403 MHz
Met Aids			Met Aids			
MetSS (E-s)			5.264B	MetSS (E-s)		
EESS (E-s)			5.264B	EESS(E-s)		
SOS (s-E)						
fixed			fixed			
mobile			mobile			
Frequency band		Max e.i.r.p. <i>limits</i> to ES MetSS & EESS				
401- 403 MHz		GSO/HEO		22 dBW		
		non-GSO (MEO and LEO)		7 dBW		

# WRC-19 AI 1.3 – MetSS & EESS Decision

## WRC-19 decision:

- ✓ **NOC** on the Agenda Item **1.3**
  - ✓ **SUP RES-766** (WRC-15) Consideration of possible upgrading of the secondary allocation to the MetSS (s-E) to primary status and a primary allocation to the EESS (s-E) in the frequency band *460-470 MHz*
- An *Ad Hoc* PLEN group was established to resolve the *issues on the pfd limits* of MetSAT(s-E) and EESS(s-E) for protection of primary FIX and MOB service
  - Due to diverging views *NO agreement* were reached on a single set of pfd limits

460 – 470 MHz		
Region 1	Region 2	Region 3
FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) 5.287 5.288 <b>5.289</b> 5.290		

**5.289** Earth exploration-satellite service applications, other than the meteorological-satellite service, may also be used in the 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



- **AI-1.7 RES-659 (WRC-15)**  
Study the spectrum needs for  
TT&C in the **SOS** for non-GSO  
satellites with  
**Short Duration Missions (SDM)**

# WRC-19 AI 7(I) – n-GSO SDM Decision 1

## WRC-19 decision:

- ✓ RES-32 (WRC-19) - Regulatory procedures for frequency assignments to non-GSO satellite systems identified as **Short-Duration Mission (SDM)** *not subject to the application of Section II of Article 9*

## ❖ non-GSO **SDM** satellite system:

- *Any space service* on bands *not subject to coordination-Section II of ART9*
- *Special provisions for non-GSO SDM SOS in 137-138 MHz (s-E) and 148-149.9 MHz (E-s)*
- Total number of satellites in a n-GSO SDM system shall not exceed **10 satellites**
- A *single launch date/DBiU* shall be defined as the launch date associated with *the first launch* (in case of a system with multiple launches)
- *Notification only after the launch* of the first satellite, and not later than two months after the launch
- The max *period of operation and validity* of frequency assignments shall not exceed **3 years** from the launch/DBiU without any possibility of extension
- Nos. **11.43A**, **11.43B** (changes) and **11.49** (suspension) shall not apply to non-GSO SDM

# WRC-19 AI 1.7 – n-GSO SDM Decision 2

## WRC-19 decision:

✓ RES-660 (WRC-19) Use of band 137 - 138 MHz (s-E) by n-GSO SDM in the **SOS** resolves

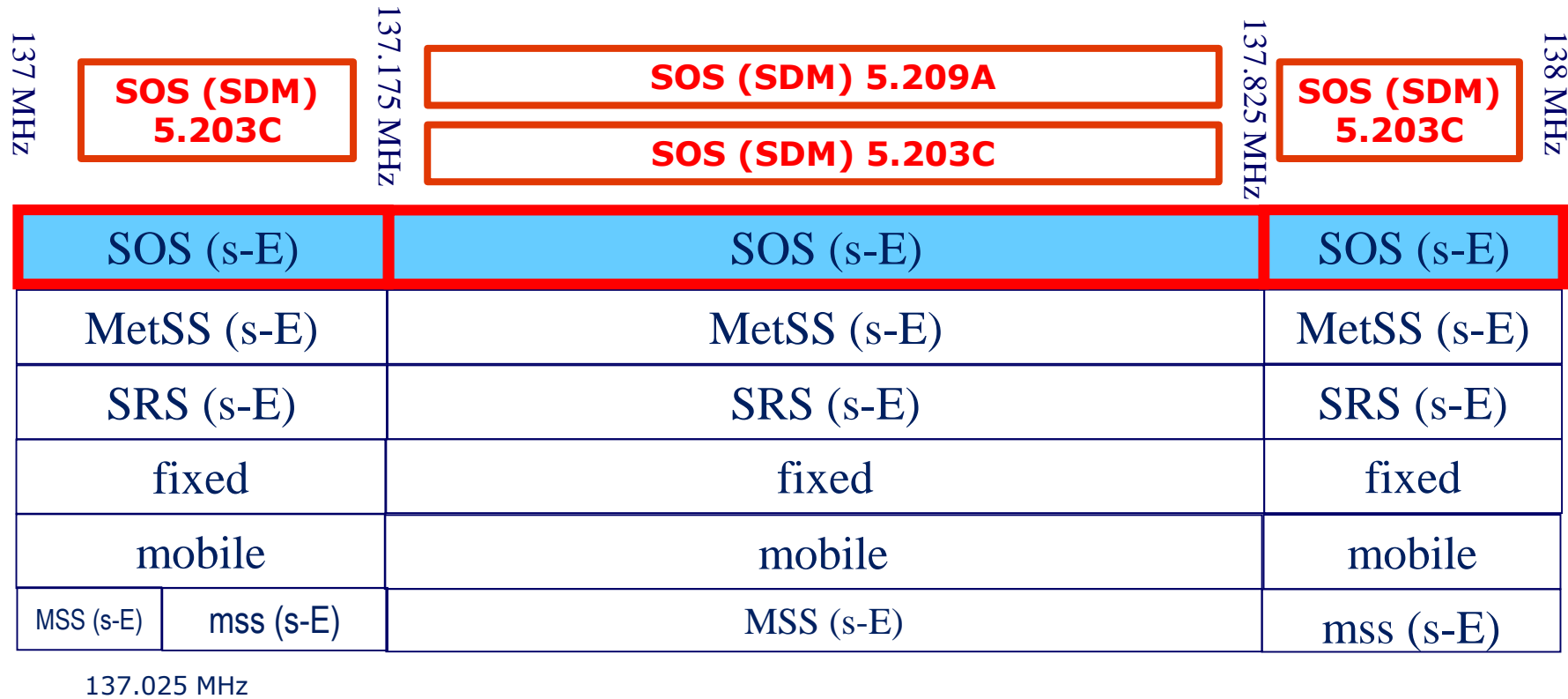
- 1) the use of n-GSO SDM **SOS** (s-E) *shall be limited to* the frequency band **137.025-138 MHz**
- 2) the *pfd limit to protect AM(R)S in the adjacent band shall not exceed -140 dB dB(W/(m<sup>2</sup> · 4 kHz)*

➤ **N-GSO SDM SOS** in 137.025-138 (s-E) and 148-149.9 MHz (E-s) systems shall not cause harmful interference to, or claim protection from, the existing services to which the frequency bands is allocated on a primary basis

- **5.203C** – Band 137.025-138 MHz for n-GSO SDM SOS (s-E) is subject to RES-660 (WRC-19). RES-32 (WRC-19 ) apply.
- **5.209A** - The use of frequency band 137.175-137.825 MHz by n-GSO SDM SOS (s-E) is NOT subject to No. 9.11A
- **5.218A** - The use of frequency band 148-149.9 MHz by n-GSO SDM in the SOS (E-s) is NOT subject to agreement No. 9.21. At the stage of coordination, the provisions of Nos. 9.17 and 9.18 also apply.
  - Additionally in the band 148–149.9 MHz a pfd limit **-149 dB** at the border of **16 countries** listed in footnote 5.218A is used for the SOS SDM **ES** as a trigger for a No.9.21 agreement with FIX and MOB



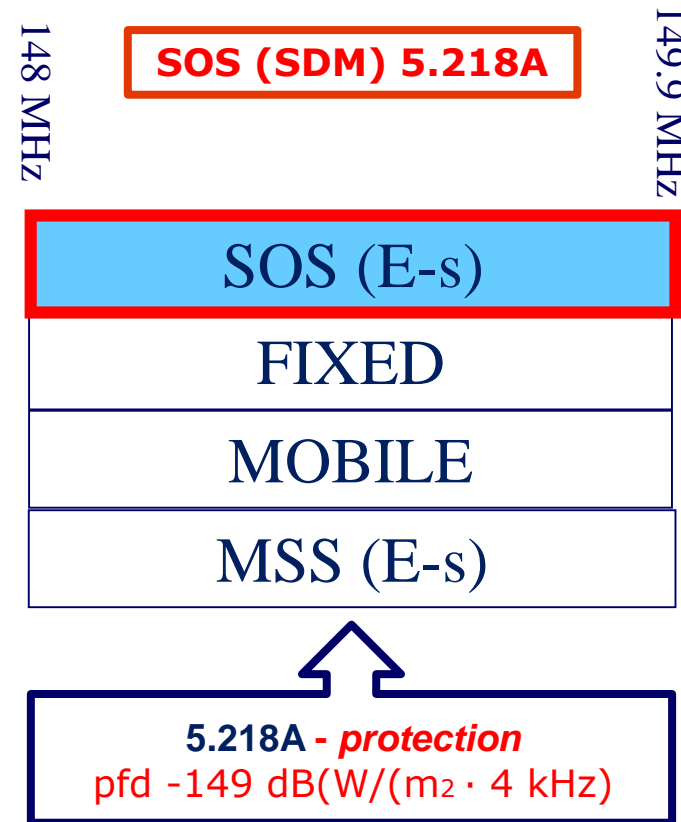
WRC-19 AI 1.7 – n-GSO SDM SOS - 137-138 MHz - Decision 3



RES-660 (WRC-19) - protection  
AM(R)S (108-137 MHz) pfd -140 dB(W/(m2 · 4 kHz

- 5.203C** The use of the SOS (s-E) with **non-GSO SDM** in the band 137-138 MHz is subject to RES-660 (WRC-19). RES-32 (WRC-19) applies. These systems shall not cause harmful interference to, or claim protection from, the existing services to which the frequency band is allocated on a primary basis.
- 5.209A** The use of the freq. band 137.175-137.825 MHz by non-GSO SDM SOS is not subject to No. 9.11A.

# WRC-19 AI 1.7 – n-GSO SDM **SOS** - 148-149.9 MHz - Decision 4



**5.218A** The frequency band 148-149.9 MHz in the SOS (E-s) maybe used by **non-GSO SDM**. Non-GSO SDM in accordance with RES-32 (WRC-19) of the RR are not subject to agreement under No. 9.21. At the stage of coordination, the provisions of Nos. 9.17 and 9.18 also apply. In the frequency band 148-149.9 MHz, non-GSO SDM shall not cause unacceptable interference to, or claim protection from, existing primary services within this frequency band, or impose additional constraints on the SOS & MSS. In addition, non-GSO SDM ES in the frequency band 148-149.9 MHz shall ensure that the pfd does not exceed  $-149 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 1% of time at the border of the territory of the following countries: [list of 16 ADM...].

In case this pfd limit is exceeded, agreement under No. 9.21 is required to be obtained from countries mentioned in this footnote.

## WRC-19 AI 7 – ART 9 Decision

**MOD 9.1** Before initiating any action under Article **11** in respect of frequency assignments for a satellite network or system not subject to the coordination procedure described in Section II of Article 9 below an administration..., shall send to the Bureau a general description of the network or system for advance publication (API) in the BR IFIC *not earlier than seven years* and *preferably not later than two years before the planned date of bringing into use* of the network or system.

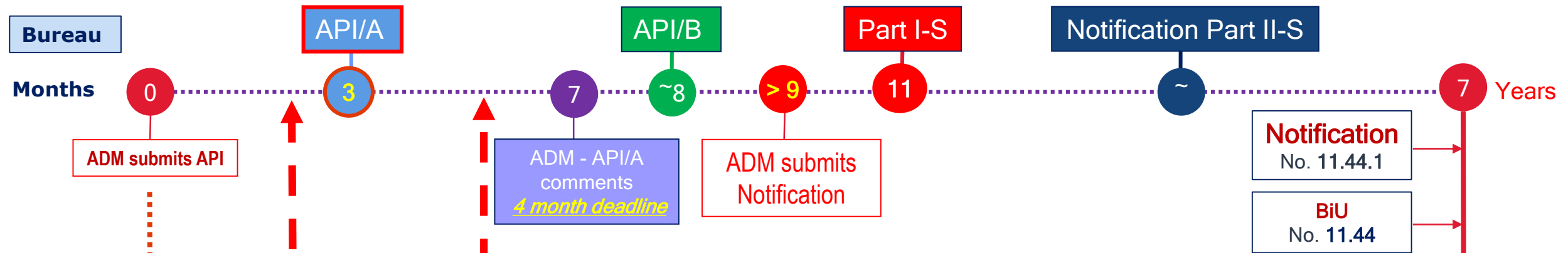
The *Notification* information may also be communicated to the Bureau at the same time, but shall be considered as having been received by the Bureau *not earlier than* ~~six~~ **four** months *after the date of publication of the API*

**MOD 9.2B** On receipt of the complete information sent under Nos. **9.1** and **9.2**, the Bureau shall publish it in a Special Section (API/A) of its BR IFIC within ~~three~~ **two** months

# WRC-19 AI 7 (I) – ART 9 Decision - *impact*

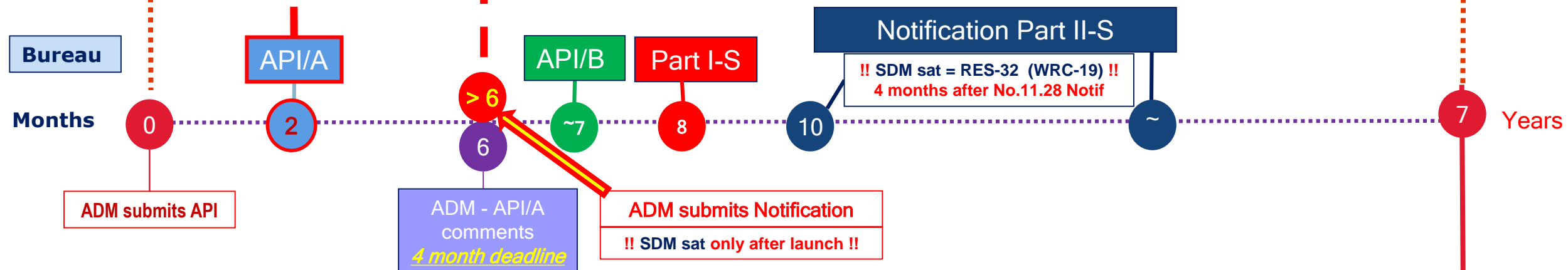
ART 9 & 11 **submission** process *timeline* for non-GSO satellite networks **NOT subject** to ART 9 Coordination – **RR@2016**

**RR@2016 API-3+6=9m Notification**

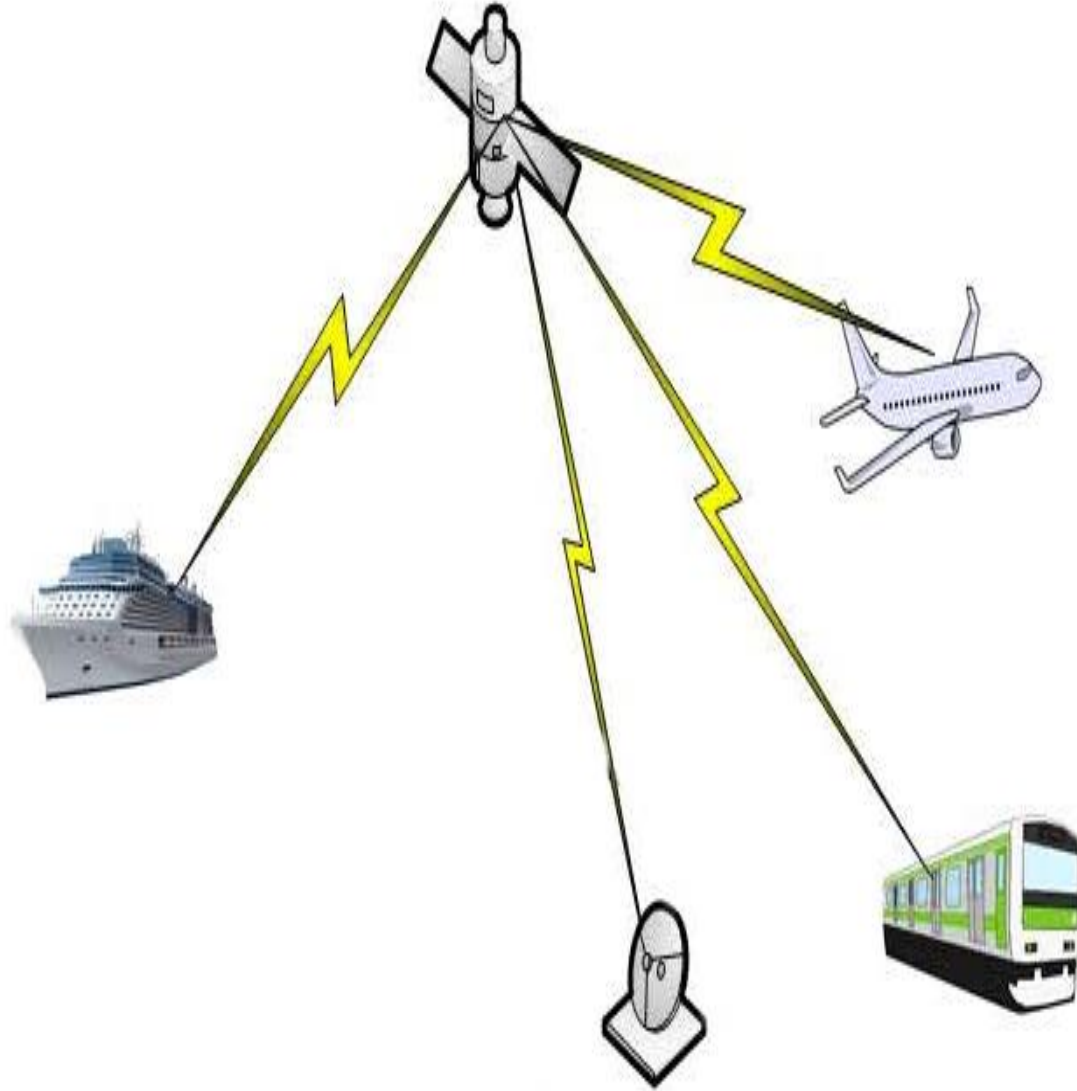


ART 9 & 11 **submission** process *timeline* for non-GSO satellite networks **NOT subject** to ART 9 Coordination – **RR@2021**

**RR@2021 API-2+4=6m Notification**



# Satellite issues - WRC-19 Agenda Item 1.5



- **AI-1.5 RES-158 (WRC-15)**  
Studies to consider the use of the bands 17.7-19.7 (s-E) & 27.5 29.5 GHz (E-s) by *earth stations in motion* (**ESIM**) communicating with GSO space stations in the **FSS** and take appropriate action



### ❖ Earth Stations in Motion (ESIM)

- *mobile* Earth station (ES) that operates in the GSO FSS
- *shall operate/communicate* within *the envelope of typical ES* of that GSO FSS satellite network

### ■ Three types / **regulatory issues** of ESIM

- **Aeronautical ESIM** on the board of aircraft – *line of sight & authorisation + pfd*
- **Maritime ESIM** on the board of vessel – *distance from the coast & authorisation + e.i.r.p*
- **Land ESIM** on the land mobile platform – *cross-border issue + No interference to TER*

# WRC-19 AI 1.5 - ESIM Decision

## WRC-19 decision:

- ✓ RES-169 (WRC-19) Use of the frequency bands 17.7-19.7 GHz (s-E) and 27.5-29.5 GHz (E-s) by earth stations in motion (ESIM) communicating with GSO FSS
  - Frequency band used by ESIMs are also allocated to *TER and SPACE services - need to be protected*;
  - *No different regulatory status* to ESIMs from the GSO FSS with which they communicate and this RES;
  - ESIM *shall protect n-GSO FSS (27.5-26.6 GHz) and n-GSO MSS feeder links (29.1-29.5 GHz)* - ESIM e.i.r.p limit apply;
  - Operation of ESIMs *within the territory*, including territorial waters and territorial airspace, of an ADM shall be carried out *only if authorized by that ADM*;
- **Land ESIM** in the frequency band 27.5-29.5 GHz (E-s) *shall not cause unacceptable interference* to terrestrial services in neighbouring countries to which the frequency band is allocated and operating in accordance with the RR
- **Maritime ESIM** transmission in the band 27.5-29.5 GHz (E-s): *operation without authorisation - min distance 70 km from the low-water mark* and max e.i.r.p +24.44 dB (W/14MHz)
- **Aero ESIM** transmission in the band 27.5-29.5 GHz (E-s):
  - *within line-of-sight* of the territory of an ADM, *above an altitude of 3 km – pfd mask* (A3.1)
  - *within line-of-sight* of the territory of an ADM, *an altitude up to 3 km – pfd mask* (A3.2)
  - within the territory of an ADM that has authorized FS or MS in the same frequency bands *ESIM shall not transmit in these bands without prior agreement (resolves 3)*



- **AI-1.6 RES-159** (WRC-15)

Studies on development of a *regulatory framework* for **non-GSO FSS** systems that may operate in the bands 37.5-39.5 (s-E), 39.5-42.5 (s-E), 47.2-50.2 (E-s), 50.4-51.4 (E-s) GHz

# WRC-19 AI 1.6 – Q/V non-GSO FSS+MSS and IMT2020 and HAPS Decision

AI  
1.6

to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands **37.5-39.5 GHz** (s-E), **39.5-42.5 GHz** (s-E), **47.2-50.2 GHz** (E-s) and **50.4-51.4 GHz** (E-s), in accordance with **RES-159** (WRC-15);

**WRC-19 decision applicable as of 23.NOV.2019** – Nos. **5.550C** & **5.550E** apply (subject to No. **9.12...**)

✓ RES-**771** (WRC-19) Use of the [Q/V frequency bands] by non-GSO FSS and MSS

1) for notification has been received by the Bureau before 23 NOV 2019 shall be brought into use before 23 NOV 2022 or the end of the regulatory period set forth in No. **11.44**, whatever date comes earlier

2) frequency assignments that are not brought into use before 23 NOV 2022 or the end of the regulatory period set forth in No. **11.44**, whatever date comes earlier, shall be suppressed

✓ RES-**770** (WRC-19) Application of RR ART **22** to protect GSO FSS & BSS from non-GSO **FSS** systems in the [Q/V bands]

1) technical characteristics of generic GSO ref. links contained in Annex 1 shall be used in conjunction with the procedures for the evaluation of interference from a non-GSO into GSO ref. links in Annex 2 to determine compliance with No. **22.5L**

2) non-GSO FSS systems referred to in resolves 1 shall receive a favourable finding with respect to the single-entry provision given in No. **22.5L**, if compliance with No. **22.5L** is established under resolves 1

✓ RES-**769** (WRC-19) Protection of GSO FSS, BSS&MSS from the aggregate interference produced by multiple non-GSO **FSS** systems in the [Q/V frequency bands]...

1) ADM operating non-GSO FSS systems, shall jointly, take all necessary steps, including mod to the operational characteristics, to ensure that the aggregate interference impact to GSO FSS... caused by such systems does not exceed the aggregate limits specified in No. **22.5M**

# Overlapping **Ka / Q / V** bands between some WRC-19 AI - **Decision**

AI 1.6 – <b>NGSO FSS</b> (GHz)	AI 1.13 – <b>IMT</b> (GHz)	AI 1.14 – <b>HAPS</b> (GHz)	AI 9.1.9 – <b>FSS</b> (GHz)
	24.25-27.5 (Global)	24.25-27.5 (R2)	
37.5-39.5 (s-E)	37-43.5 (Global)	38-39.5 (Global)	
39.5-42.5 (s-E)	40.5-42.5		
47.2-50.2 (E-s)	47.2-50.2		
50.4-51.4 (E-s)	50.4-52.6		51.4-52.4 (E-s)

**AI 1.13 - WRC-19 decision - 10 times increase of IMT bands compared to WRC-15 (current RR):**

- ✓ Agreed on **Global IMT identification** and conditions for the bands 24.25-27.5, 37-43.5 and 66-71 GHz = 14.75 GHz
- ✓ Agreed on **Restricted (regional) IMT identification** and conditions for the bands 45.5-47.0 and 47.2-48.2 GHz = 2.5 GHz
- ✓ **NOC** for the candidate bands 31.8 - 33.4, 47 - 47.2, 48.2 - 50.2, 50.4 - 52.6, 71 - 76 and 81 - 86 GHz

**AI 1.14 - WRC-19 decision:**

- ✓ Agreed on **Global HAPS identification** and conditions (RES) for the bands 31-31.3 & 38-39.5 GHz
- ✓ Agreed on **Restricted (regional) identification** and conditions (RES) for the bands 21.4-22, 24.25 & 25.25-27.4 GHz
- ✓ **NOC** for the bands 6 440 - 6 520 / 6 560 - 6 640 MHz (No.5.547)

WRC-19 <b>non-GSO FSS+MSS</b>	WRC-19 IMT <i>identification</i> / RR Regions		WRC-19 HAPS <i>identification</i> / RR Regions		WRC-19 <b>FSS</b>
			21.4-22	<b>R2</b> (No.5.530E)	
	24.25-27.5	<b>GLOBAL</b> (No. 5.532AB)	24.25-27.5	<b>R2</b> (Nos. 5.532AA, 5.534A)	
	31.8-33.4	<b>NOC</b>	31.0-31.3	<b>GLOBAL</b> (No. 5.543B)	
<b>37.5-39.5&amp; 39.5-42.5 (s-E)</b> (Nos.5.550C+5.550E)	37-43.5	<b>GLOBAL</b> (No. 5.550B)	38.0-39.5	<b>GLOBAL</b> (No. 5.550D)	
	45.5-47.0	No. 5.553A			
	47.0-47.2	<b>NOC</b>			
<b>47.2-50.2 (E-s) (No.5.550C)</b>	47.2-48.2	<b>R2 + No. 5.553B</b>			
	48.2-50.2	<b>NOC</b>			
<b>50.4-51.4 (E-s) (No.5.550C)</b>	50.4-52.6	<b>NOC</b>			<b>51.4-52.4 (E-s) (No.5.555C)</b>
	66-71	<b>GLOBAL</b> (No. 5.559AA)			
	71-76	<b>NOC</b>			
	81-86	<b>NOC</b>			



# WRC-19 Decision - RR Article 5 - IMT+HAPS+non-GSO FSS+MSS in Q band (37.0 - 43.5 GHz)

## AI 1.13 - WRC-19 decision in Q band

- ✓ Agreed on **Global IMT** *identification* and conditions for the bands 37-43.5 GHz
- ✓ No. **5.550B** and RES-**243** (WRC-19) - Terrestrial component of **IMT** within the bands 37-43.5 and 47.2-48.2 GHz

## AI 1.14 - WRC-19 decision in Q band:

- ✓ Agreed on **Global HAPS** *identification* and conditions (RES) for the band 38-39.5 GHz
- ✓ No. **5.550D** and RES-**168** (WRC-19) - Use of the frequency band 38-39.5 GHz by **HAPS** in the FS

## AI 1.6 - WRC-19 decision applicable as of 23.11.2019

- ✓ Nos. **5.550C+5.550E** & RES-**771** (WRC-19) Use of the frequency band **37.5-39.5 GHz (s-E)**, **39.5-42.5 GHz (s-E)** by **non-GSO FSS** and **MSS**
- ✓ RES-**770** (WRC-19) Application of RR ART **22** to protect GSO FSS & BSS from non-GSO FSS systems in the [Q/V... bands]
- ✓ RES-**769** (WRC-19) Protection of GSO FSS, BSS & MSS from the *aggregate interference* produced by multiple non-GSO FSS systems in the [Q/V... bands]

37 GHz	IMT	37.5 GHz	IMT	38 GHz	IMT+HAPS	39.5 GHz	non-GSO FSS	40 GHz	IMT	40.5 GHz	non-GSO FSS MSS	41 GHz	IMT	41.5 GHz	non-GSO FSS	42.5 GHz	IMT	42.5 GHz	IMT
	FS		FS		FS-HAPS		FS		FS		FS		FS		FS		FS		FS
			FSS (s-E)		FSS (s-E)		FSS (s-E)		FSS (s-E)		FSS (s-E)		FSS (s-E)		FSS (s-E)		FSS (E-s)		
	MOB		MOB		MOB		MOB		MOB		MOB		MOB		MOB		MOB		
	SRS (E-s)		SRS (E-s)				MSS (s-E)		MSS (s-E)		MSS (s-E)		BS		BS		RAS		
			eess (s-E)		eess (s-E)		eess (s-E)		eess (s-E)		eess (s-E)		BSS		BSS				
									SRS (E-s)		SRS (E-s)		mss (s-E)		mss (s-E)				
									EESS (E-s)		EESS (E-s)		ams&mms		ams&mms				

WRC-19 Decision - RR Article 5 - IMT+HAPS+non-GSO FSS in V band (45.5 - 51.4 GHz)

AI 1.13 - WRC-19 decision in V band

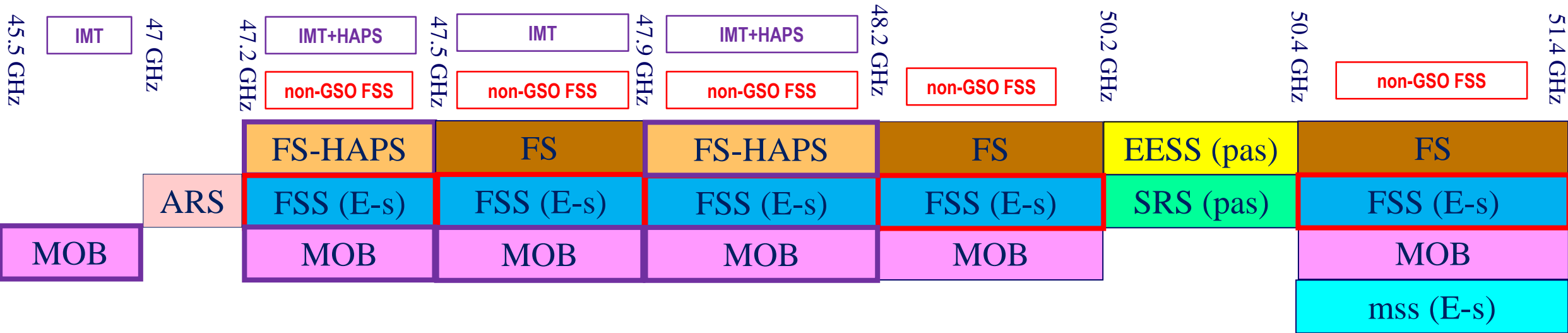
- ✓ Agreed on **Global IMT** *identification* and conditions for the bands 47.2 - 5 GHz
- ✓ Nos.5.553A, 5.553B
- ✓ RES-243 (WRC-19) - Terrestrial component of **IMT** within the bands 37-43.5 and 47.2-48.2 GHz
- ✓ RES-244 (WRC-19) - **IMT** in the frequency band 45.5-47 GHz

AI 1.14 - WRC-19 decision:

- ✓ Agreed on **Global HAPS** *identification* and conditions (RES) for the band 38-39.5 GHz
- ✓ MOD No. 5.552A and MOD RES-122 (WRC-19) - Use of the frequency band 47.2-47.5 & 47.9-48.2 GHz by **HAPS** in the FS

AI 1.6 - WRC-19 decision *applicable as of 23.11.2019*

- ✓ Nos. 5.550C & RES-771 (WRC-19) Use of the frequency band 47.2-50.2 GHz (E-s) and 50.4-51.4 GHz (E-s) by **non-GSO FSS**
- ✓ RES-770 (WRC-19) Application of RR ART 22 to protect GSO FSS & BSS from non-GSO FSS systems in the [Q/V... bands]
- ✓ RES-769 (WRC-19) Protection of GSO FSS, BSS & MSS from the *aggregate interference* produced by multiple non-GSO FSS systems in the [Q/V... bands]



# Space **REGULATORY** issues - WRC-19 Agenda Item 7

AI 7

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

## 11 issues identified under AI 7 and *consideration of Dir Rep (AI 9.2) & RRB Rep (AI 9.3)*

- Issue **A** – *Bringing into use* of frequency assignments to all non-GSO systems, and consideration of a *milestone-based approach* for the deployment of *non-GSO systems in specific frequency bands and services*
- Issue **B** – Application of coordination arc in the Ka-band, to determine coordination requirements between the FSS and other satellite services
- Issue **C** – Issues for which *consensus* was achieved in ITU-R and a *single method has been identified*
- Issue **D** – *Identification* of those specific satellite networks and systems with which *coordination needs* to be effected under RR Nos. **9.12** (n-GSO-to-n-GSO), **9.12A** (n-GSO-to-GSO) and **9.13** (GSO-to-n-GSO)
- Issue **E** - Resolution related to RR Appendix 30B
- Issue **F** – Measures to facilitate entering new assignments into the RR Appendix 30B List
- Issue **G** – Updating the reference situation for Regions 1 and 3 networks under RR Appendices 30 and 30A when provisionally recorded assignments are converted into definitive recorded assignments
- Issue **H** – *Modifications to RR Appendix 4 data* items to be provided for *non-GSO satellite systems*
- Issue **I** – Regulatory procedure for non-GSO satellite systems with short-duration missions (**SDM**)
- Issue **J** – Pfd limit in Section 1, Annex 1 of RR Appendix 30
- Issue **K** – Difficulties for Part B examinations under § 4.1.12 or 4.2.16 of RR Appendices 30 and 30A and § 6.21 c) of RR Appendix 30B
- ✓ Agenda item **9.2** – *Director's Report* on any difficulties or inconsistencies encountered in the application of the Radio Regulations
- ✓ Agenda item **9.3** – *RRB report* on action in response to **RES-80**

# WRC-19 AI 7 (A) – ART 11 BIU Decision

**MOD 11.44B** A frequency assignment to a space station in the GSO shall be considered as having been brought into use when a space station in the GSO with the capability of transmitting or receiving that frequency assignment *has been deployed and maintained at the notified orbital position for a continuous period of 90 days*. The notifying ADM shall so inform the Bureau within 30 days from the end of the 90-day period...**RES-40** shall apply

**MOD 11.44C** A frequency assignment to a space station in a non-GSO system in the FSS, MSS or BSS shall be considered as having been brought into use when a space station with the capability of transmitting or receiving that frequency assignment *has been deployed and maintained on one of the notified orbital plane(s) of the non-GSO system for a continuous period of 90 days, irrespective of the notified number of orbital planes and satellites per orbital plane in the network or system*. The notifying ADM shall so inform the Bureau within 30 days from the end of the 90-day period...

**MOD 11.44D** A frequency assignment to a space station in a non-GSO system with "Earth" as the reference body, other than a frequency assignment to which No. **11.44C** applies, shall be considered as having been brought into use when *a space station* with the capability of transmitting or receiving that frequency assignment has been deployed **on one of the notified orbital plane(s)** of the non-GSO system, *irrespective of the notified number of orbital planes and satellites per orbital plane in the system*. The notifying ADM shall so inform the Bureau as soon as possible, but not later than 30 days after the end of the period under No. **11.44**

**MOD 11.44E** A frequency assignment to a space station in a non-GSO system with a the reference body that is not "Earth", shall be considered as having been brought into use when *the notifying ADM informs the Bureau that a space station* with the capability of transmitting or receiving that frequency assignment has been deployed **in accordance with the notification information**. The notifying ADM shall so inform the Bureau as soon as possible, but not later than 30 days after the end of the period under No. **11.44**

# Non-GSO FSS satellite system & the RR - 1

There is *no formal regulatory* definition in the RR related to "Satellite large **MEGA** constellation"

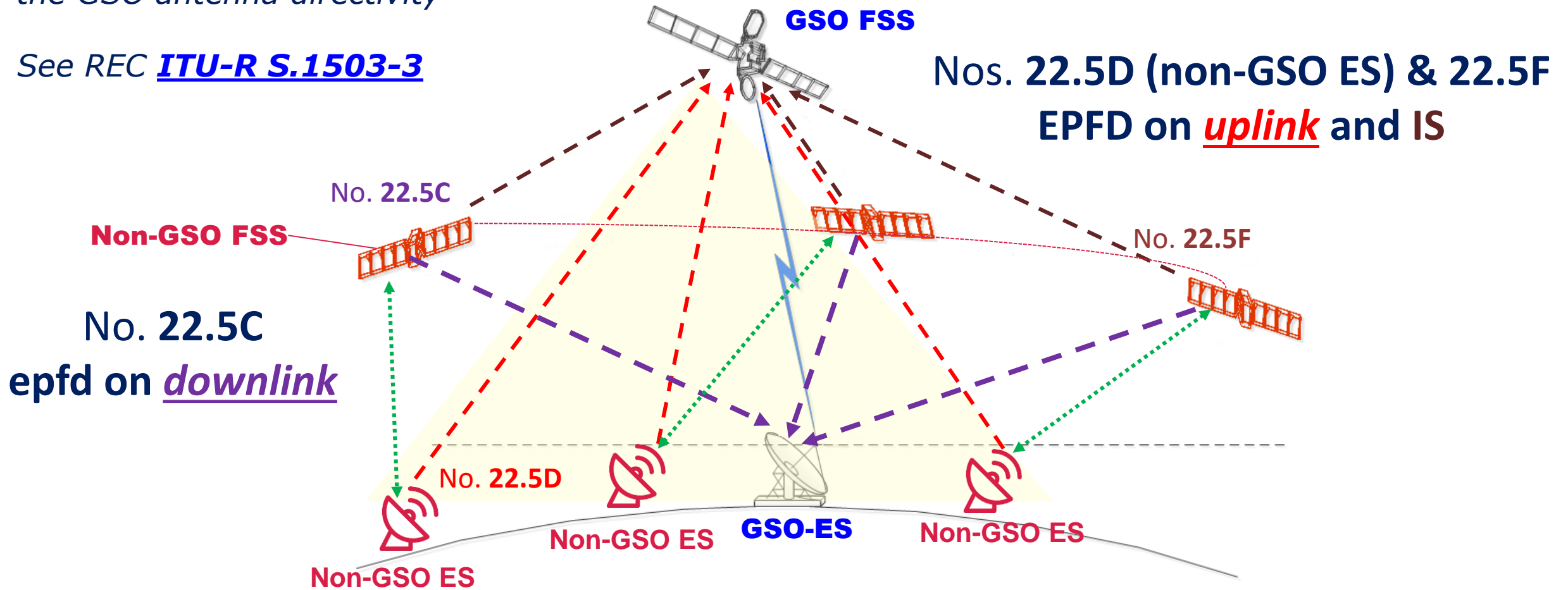
- It can be considered as *a constellation* comprised of *a group of non-GSO satellites* operating in the frequency bands allocated to the Fixed-Satellite service (**FSS**) (No.1.21)
  - with *similar characteristics and functions*
  - operating in *a similar or complementary orbital planes at LEO, MEO or HEO*
  - *under a shared control*
  - for *a coordinated ground coverage*
- ❖ No. **22.2** Non-GSO systems *shall not cause unacceptable interference to / not claim protection* from GSO FSS & BSS (*ULTIMATE protection*)
- ❖ According to No. **22.5I** - No. **22.2** obligation is *fulfilled* by the non-GSO FSS, *if they comply with **epfd** limits*, given in Tables 22-x of ART **22** *without requiring individual coordinations with all GSO systems worldwide*



# Non-GSO FSS EPFD & the RR - 2

*Equivalent power-flux density (epfd) takes into account the aggregate of the emissions from all non-GSO satellites in the direction of any GSO satellite and GSO earth station, taking into account the GSO antenna directivity*

See REC [ITU-R S.1503-3](#)



# WRC-19 AI 7 (A) – non-GSO FSS BiU & milestone Decision 1

RES-35 (WRC-19) - A milestone-based approach for the implementation to space stations in a non-GSO system in *specific frequency bands and services*

- ❖ ITU-R studies results (see CPM-19-2 Report to WRC-19 Agenda item 7(A))
- adoption of a milestone-based approach will provide *a regulatory mechanism to help ensure that the MIFR reasonably reflects the actual deployment of such non-GSO systems* and improve the *efficient use of the orbital/spectrum resource in those frequency bands and services*;
- in defining the timeline and objective criteria for the milestone-based approach, there is a need to seek *a balance between the prevention of spectrum warehousing, the proper functioning of coordination mechanisms, and the operational requirements* related to the deployment of a non-GSO system;
- *adherence to fixed milestone periods is desirable*, as this creates certainty with respect to the deployment
- ✓ *Specific* frequency bands in **Ku, Ka, Q** and **V** – applicable to non-GSO systems in FSS, BSS or MSS - see *resolves 1 Table*

## WRC-19 AI 7 (A) – non-GSO FSS BiU & milestone Decision 2

- *resolves 2) - for frequency assignments to which resolves 1 applies, and for which the end of the 7-year regulatory period (No. **11.44**) is on or after 1 JAN 2021, the notifying ADM shall communicate the required deployment info (Annex 1 to this RES) no later than 30 days after the end of the regulatory period (No. **11.44**) or BiU in No. **11.44C**, whichever comes later*
- *resolves 3) - for frequency assignments to which resolves 1 applies, and for which the end of the 7-year regulatory period (No. **11.44**) has expired prior to 1 JAN 2021, the notifying ADM shall communicate the required deployment info (Annex 1 to this RES) no later than 1 FEB 2021*
- *resolves 5) - if the number of satellites under resolves 2 or 3 above is **100%** of the total number of satellites indicated in the MIFR, milestone resolves 6 to 17 are not applicable*

# WRC-19 AI 7 (A) – non-GSO FSS BiU & milestone Decision 3

<p><i>resolves 2</i> (No.11.44 <u>on / after 1JAN 2021</u>)</p> <p>period under <i>resolves 6</i></p>	<p><i>resolves 3</i> (No.11.44 expired <u>prior 1JAN 2021</u>)</p> <p>dates under <i>resolves 7</i></p>	<p><i>resolves 10</i> number of space stations <b><i>declared as deployed</i></b> <i>under resolves 6 or 7</i> <i>is equal or more as</i></p>	<p><i>resolves 10</i> <b>ADM shall submit a MOD</b> to the <i>notified characteristics</i> if the number of space stations <i>declared as deployed is</i></p>
<p>a) <i>30 days after</i> the expiry of the <b>2-year period</b> after No.11.44 <i>(i.e. 9 years after CR submission)</i></p>	<p>a) <i>no later than</i> <b>1 FEB 2023</b> <i>(i.e.1JAN+30days)</i></p>	<p>a) <b>≥10% of the total</b> number of satellites - <b>OK</b></p>	<p>a) <b>&lt;10%</b> - the modified total number of satellites <b>shall not be greater than ten (10) times</b> the number of space stations declared as deployed under <i>resolves 6a) or 7a)</i></p>
<p>b) <i>30 days after</i> the expiry of the <b>5-year period</b> after No.11.44 <i>(i.e. 12 years after CR submission)</i></p>	<p>b) <i>no later than</i> <b>1 FEB 2026</b> <i>(i.e.1JAN+30days)</i></p>	<p>b) <b>≥50% of the total</b> number of satellites - <b>OK</b></p>	<p>b) <b>&lt;50%</b> - the modified total number of satellites <b>shall not be greater than two (2) times</b> the number of space stations declared as deployed under <i>resolves 6b) or 7b)</i></p>
<p>c) <i>30 days after</i> the expiry of the <b>7-year period</b> after No.11.44 <i>(i.e. 14 years after CR submission)</i></p>	<p>c) <i>no later than</i> <b>1 FEB 2028</b> <i>(i.e.1JAN+30days)</i></p>	<p>c) <b>=100% of the total</b> number of satellites - <b>OK</b></p>	<p>c) <b>&lt;100%</b> - the modified total number of satellites <b>shall not be greater than the number of space stations deployed</b> under <i>resolves 6c) or 7c)</i></p>

# WRC-19 AI 7 (A) – non-GSO FSS BiU & milestone Decision 4

- *resolves 8)* – processing of information under *resolves 6 or 7* by the Bureau
- *resolves 9 c)* - that, upon receipt of the required deployment information submitted in accordance with *resolves 6 or 7*, the Bureau shall modify the MIFR entry *to remove the remark added* according to *resolves 4b)* stating that the assignments are subject to the application of this RES *is 100% of the total number of satellites*
- *resolves 11)* - *resolves 10a)* *shall not apply for frequency assignments for which the end of the seven-year regulatory period in No. 11.44 is before 28 November 2022*, provided that the notifying ADM submits the complete information listed in **Annex 2** to the Bureau by 1 March 2023, and a favourable determination is made by the RRB or WRC-23, as described below:
  - a) upon receipt of this complete information, the Bureau shall report it to the RRB as soon as possible, *but no later than 1 April 2023*, in order to enable comments from administrations and consideration by the RRB at its second meeting in 2023, at the latest;
  - b) the RRB shall consider the information provided under this *resolves* and provide *a report with its conclusions or recommendations to WRC-23*, including any cases where RRB is not in a position to conclude favourably;

## **ANNEX 2 TO RES-35** - Information to be provided by notifying adm pursuant to *resolves 11*

1. Reference to Notification Information already submitted
2. Current deployment and operational information
3. Report indicating efforts made and detailing status of coordination
4. Clear evidence of a binding agreement for the manufacture or procurement of a sufficient number of satellites to meet the milestone obligation in *resolves 6b) or 7b)*, as appropriate
5. Clear evidence of a binding agreement to launch a sufficient number of satellites to meet the milestone obligation in *resolves 6b) or 7b)*, as appropriate



# WRC-19 – WRC-23 Agenda Items Decision

RES-**811** (WRC-19) Agenda for the 2023 World Radiocommunication Conference

see WRC-19 Provisional Final Acts

*and*

*Conference Preparatory Meeting (**CPM**) to WRC-23 website CPM-23*

# WRC-19 – WRC-23 Agenda Items Decision 1

## RES-811 (WRC-19) Agenda for the 2023 World Radiocommunication Conference

AI	TASK
1.1	to consider, based on the results of the ITU-R studies, possible measures to address, in the frequency band 4 800-4 990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the pfd criteria in No. <b>5.441B</b> in accordance with RES- <b>223</b> (WRC-15)
1.2	to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with RES- <b>245</b> (WRC-19)
1.3	to consider primary allocation of the band 3 600-3 800 MHz to mobile service within Region 1 and take appropriate regulatory actions, in accordance with RES- <b>246</b> (WRC-19)
1.4	to consider, in accordance with RES- <b>247</b> (WRC-19), the use of high altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level
1.5	to review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review in accordance with RES- <b>235</b> (WRC-15);

# WRC-19 – WRC-23 Agenda Items Decision 2

AI	TASK
1.6	to consider, in accordance with RES- <b>772</b> (WRC-19), regulatory provisions to facilitate radiocommunications for sub-orbital vehicles
1.7	to consider a new AMS(R)S allocation in accordance with RES- <b>428</b> (WRC-19) for both the E-s and s-E directions of aeronautical VHF communications in all or part of the frequency band 117.975-137 MHz, while preventing any undue constraints on existing VHF systems operating in the AM(R)S, the ARNS, and in adjacent frequency bands
1.8	to consider, on the basis of ITU-R studies in accordance with RES- <b>171</b> (WRC-19), appropriate regulatory actions, with a view to reviewing and, if necessary, revising RES- <b>155</b> (Rev.WRC-19) and No. <b>5.484B</b> to accommodate the use of FSS networks by control and non-payload communications of unmanned aircraft systems
1.9	to review AP <b>27</b> of the RR and consider appropriate regulatory actions and updates based on ITU-R studies, in order to accommodate digital technologies for commercial aviation safety-of-life applications in existing HF bands allocated to the aeronautical mobile (Route) service and ensure coexistence of current HF systems alongside modernized HF systems, in accordance with RES- <b>429</b> (WRC-19);
1.10	to conduct studies on spectrum needs, coexistence with radiocommunication services and regulatory measures for possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications, in accordance with RES- <b>430</b> (WRC-19);

# WRC-19 – WRC-23 Agenda Items Decision 3

AI	TASK
<b>1.11</b>	to consider possible regulatory actions to support the modernization of the GMDSS and the implementation of e-navigation, in accordance with RES- <b>361</b> (Rev.WRC-19)
<b>1.12</b>	to conduct, and complete in time for WRC-23, studies for a possible new secondary allocation to the Earth exploration-satellite (active) service for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with RES- <b>656</b> (WRC-19)
<b>1.13</b>	to consider a possible upgrade of the allocation of the frequency band 14.8-15.35 GHz to the space research service, in accordance with RES- <b>661</b> (WRC-19);
<b>1.14</b>	to review and consider possible adjustments of the existing or possible new primary frequency allocations to EESS (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with RES- <b>662</b> (WRC-19);
<b>1.15</b>	to harmonize the use of the frequency band 12.75-13.25 GHz (E-s) by ES on aircraft and vessels communicating with GSO FSS globally, in accordance with RES- <b>172</b> (WRC-19)
<b>1.16</b>	to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (s-E) and 27.5-29.1 GHz and 29.5-30 GHz (E-s) by non-GSO FSS ESIM, while ensuring due protection of existing services in those frequency bands, in accordance with RES- <b>173</b> (WRC-19)

# WRC-19 – WRC-23 Agenda Items Decision 4

AI	TASK
1.17	to determine and carry out, on the basis of the ITU-R studies in accordance with RES- <b>773</b> (WRC-19), the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate
1.18	to consider studies relating to spectrum needs and potential new allocations to the MSS for future development of narrowband MSS, in accordance with RES- <b>248</b> (WRC-19)
1.19	to consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2, while protecting existing primary services in the band, in accordance with RES- <b>174</b> (WRC-19)
7	to consider possible changes, in response to RES- <b>86</b> of the PP, on advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with RES- <b>86</b> (Rev.WRC-07), in order to facilitate the rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit



# WRC-19 – WRC-23 Agenda Items Decision 5

AI	TASK
9.1.1	In accordance with RES- <b>657</b> (Rev.WRC-19), review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the RR without placing additional constraints on incumbent services
9.1.2	Review of the ARS and the ARSS allocations in the frequency band 1 240-1 300 MHz to determine if additional measures are required to ensure protection of the RNSS (s-E) service operating in the same band in accordance with RES- <b>774</b> (WRC-19)
9.1.3	Study the use of IMT system for fixed wireless broadband in the frequency bands allocated to the FX services on primary basis, in accordance with RES- <b>175</b> (WRC-19)
9.2	Report of the Director on any difficulties or inconsistencies encountered in the application of the Radio Regulations
9.3	Action in response to RES- <b>80</b> (Rev.WRC-07);

Colour code explanation
Terrestrial services
Maritime and Aeronautical services
IMT
Space Science services
Space services
Dir Report & RRB

# WRC-23 **AI.1.6** - sub-orbital vehicles

**AI 1.6** - to consider, in accordance with RES-772 (WRC-19), regulatory provisions to facilitate radiocommunications for sub-orbital vehicles

**RES-772 (WRC-19)** - Consideration of regulatory provisions to facilitate the introduction of sub-orbital vehicles

*resolves to invite ITU-R*

- 1) to study spectrum needs for communications between stations on board sub-orbital vehicles and terrestrial/space stations providing functions such as, inter alia, voice/data communications, navigation, surveillance and TT&C;
- 2) to study appropriate modification, if any, to the RR, excluding any new allocations or changes to the existing allocations in ART 5, to accommodate stations on board sub-orbital vehicles, whilst avoiding any impact on conventional space launch systems with the following objectives:
  - *to determine the status of stations on sub-orbital vehicles, and study corresponding regulatory provisions to determine which existing radiocommunication services can be used by stations on sub-orbital vehicles, if necessary;*
  - *to determine the technical and regulatory conditions to allow some stations on board sub-orbital vehicles to operate under the aeronautical regulation and to be considered as earth stations or terrestrial stations even if a part of the flight occurs in space;*
  - *to facilitate radiocommunications that support aviation to safely integrate sub-orbital vehicles into the airspace and be interoperable with international civil aviation;*
  - *to define the relevant technical characteristics and protection criteria relevant for the studies to be undertaken - see point below;*
  - *to conduct sharing and compatibility studies with incumbent services that are allocated on a primary basis in the same and adjacent frequency bands in order to avoid harmful interference to other radiocommunication services and to existing applications of the same service in which stations on board sub-orbital vehicles operate, having regard to the sub-orbital flight application scenarios;*
- 3) to identify, as a result of the studies above, whether there is a need for access to additional spectrum that should be addressed after WRC-23 by a future competent conference

❖ *resolves to invite WRC-23*

to consider the results of the studies above and take the appropriate action

# WRC-23 **AI.1.16** – n-GSO FSS ESIM in Ka

**AI 1.16** - to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (s-E) and 27.5-29.1 GHz and 29.5-30 GHz (E-s) by non-GSO FSS ESIM, while ensuring due protection of existing services in those frequency bands, in accordance with RES-**173**(WRC-19)

RES-**173** (WRC-19) - Use of the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (s-E) and 27.5-29.1 GHz and 29.5-30 GHz (E-s) by ESIMs communicating with non-GSO FSS

*resolves to invite ITU-R*

- 1) to study the technical and operational characteristics and user requirements of the different types of ESIM that plan to operate within non-GSO FSS systems in the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (s-E) and 27.5-29.1 GHz and 29.5-30 GHz (E-s), or parts thereof;
- 2) to study sharing and compatibility between ESIM operating with non-GSO FSS systems and current and planned stations of primary services allocated in the bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (s-E) and 27.5-29.1 GHz and 29.5-30 GHz (E-s), or parts thereof, to ensure protection of, and not impose additional constraints on, GSO systems and other services, including terrestrial services, in those frequency bands and in adjacent bands, including passive services;
- 3) to develop the technical and regulatory provisions for the operation of aeronautical and maritime ESIM with non-GSO FSS systems, taking into account the results of studies under resolves to invite ITU-R 1 and 2;
- 4) to ensure that the technical and operational measures and the possible regulatory changes established in accordance with this Resolution shall not affect the relevant provisions related to the protection of GSO networks from non-GSO FSS systems;
- 5) to ensure that the results of ITU-R studies are agreed by Member States taking into account the required consensus on this matter;
- 6) to complete studies in time for WRC-23,

❖ *resolves to invite WRC-23*

to review the results of these studies and take appropriate action

# WRC-23 **AI.1.18** – narrowband (IoT) MSS

**AI 1.18** - to consider studies relating to spectrum needs and potential new allocations to the MSS for future development of narrowband MSS, in accordance with **RES-COM6/15**

✓ **RES-248** (WRC-19) - Studies relating to spectrum needs and potential new allocations to the MSS in the bands 1 695-1 710 MHz, 2 010-2 025 MHz, 3 300-3 315 MHz, 3 385-3 400 MHz for future **development of narrow band MSS**

*resolves to invite ITU-R*

- 1) to conduct studies on spectrum, operational requirements and system characteristics of *low-data rate systems for the collection of data from, and management of, terrestrial devices in the MSS*
- 2) to conduct sharing and compatibility studies with existing primary services to determine the suitability of new allocations to the MSS, with a view to protecting the primary services, in the following frequency bands:
  - 1 695-1 710 MHz in Region 2
  - 2 010-2 025 MHz in Region 1
  - 3 300-3 315 & 3 385-3 400 MHz in Region 2

❖ *resolves to invite WRC-23*

*to determine, on the basis of the studies conducted under the resolves to invite ITU-R above, appropriate regulatory actions*

# WRC-23 AI.9.1.2 – RNSS / ARS

**AI 9.1.2** – to review of the ARS and the ARSS allocations in the frequency band 1 240-1 300 MHz to determine if additional measures are required to ensure protection of the RNSS (s-E) service operating in the same band in accordance with RES-774 (WRC-19)

RES-774 (WRC-19) - Studies on technical and operational measures to be applied in the frequency band 1 240-1 300 MHz to ensure the protection of the RNSS (s-E)

*resolves to invite ITU-R*

1) to perform the detailed review of the different systems and applications used in the amateur service and amateur-satellite service allocations within the frequency band 1 240-1 300 MHz;

2) taking into account the results of the above review, to study possible technical and operational measures to ensure the protection of RNSS (s-E) receivers from the amateur and amateur-satellite services within the frequency band 1 240-1 300 MHz, *without considering the removal of these amateur and amateur-satellite services allocations*

❖ instructs the Director of the Radiocommunication Bureau to include the results of these studies in his Report to WRC-23 for the purpose of considering appropriate actions in response to resolves to invite ITU-R above.



RES-249 (WRC-19) - Study of technical and operational matters, and regulatory provisions, for **space-to-space** transmissions in the

- (E-s) direction in the frequency bands [1 610-1 645.5 and 1 646.5-1 660.5 MHz] and
- (s-E) direction in the bands [1 525-1 544 MHz, 1 545-1 559 MHz, 1 613.8-1 626.5 MHz and 2 483.5-2 500 MHz]

among **non-GSO and GSO operating in the MSS**

*[xx] – subject to WRC-23 consideration and review the inclusion of these frequency bands with square brackets and decision, as appropriate*

- to complete these studies by the WRC-27

❖ *resolves to invite WRC-27*

to consider the results of the above studies and take necessary regulatory actions, as appropriate

## ***Links to **free** online access to the ITU-R information***

- **World Radiocommunication Conference (WRC-19)**  
<https://www.itu.int/go/wrc-19>
- **Final Acts WRC-19**
- ***ITU-Radio Regulations @ 2016***
- ***ITU-R Recommendations***

***Thank you very much for  
your attention !***

**World Radiocommunication Conference (WRC-19)**

**<https://www.itu.int/go/wrc-19>**