Session 14: Key Issues for Satellite Industry WRC-19

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ITU-PP-18 -Res 203 Outcome

Resolution 203 on connectivity that identifies access to spectrum by satellite on equal footing with terrestrial fixed and mobile, as important for broadband services and applications'

Resolution 203 Recognizing

a) that connectivity to broadband network is directly and indirectly enabled and supported by many diverse technologies, including fixed and mobile terrestrial technologies and **fixed and mobile satellite technologies**;

b) that **spectrum is essential** both for the direct provision of wireless broadband connectivity to users by **satellite** and terrestrial means and for the underlying enabling technologies;

Invites Member States

4. To facilitate connectivity to **satellite** and terrestrial broadband networks, including **enabling access to spectrum**, as appropriate, as one important component of access to broadband services and applications, including to remote, underserved and unserved areas;

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WRC-19 Satellite Overview

3 categories of Agenda Items:

- **Defend existing satellite spectrum**
- **Study regulatory/flexibility aspects for satellite services**
- **Obtain new satellite spectrum**

Defend Existing Satellite Spectrum

- ❑ AI 1.8: GMDSS
- ❑ AI 1.14: HAPS
- ❑ **AI 1.13: New spectrum for IMT/5G**
- ❑ AI 1.16: More C & spectrum RLAN

Study Regulatory Flexibility

- ❑ AI 1.4: Review Ku-band (BSS) orbital position restrictions
- ❑ **AI 1.5: ESIMs in Ka-band**
- ❑ AI 1.6: NGSOs in Q/V bands
- ❑ **AI 7: Coordination Procedures**
- ❑ AI 9.1.3: NGSOs in C band
- ❑ AI 9.1.7: Unlicensed VSATs

Obtain Satellite Spectrum

- ➢ **AI 9.1.9: More FSS spectrum**

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Chapter 2: AI: 1.13

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AI 1.13 Additional spectrum for IMT

Goal: To preserve access to satellite spectrum for existing and future systems

- **Genesis**: Resolution 238 (WRC-15)
- **Issue**: 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.

Background: 33.25 GHz of additional spectrum has been identified at WRC-15 as candidate bands for further studies for 5G/IMT.

- This is sufficient spectrum from which to find 'more' spectrum for IMT/mobile/5G
- Important to consider ONLY these bands which were identified as candidate bands on the basis of global consensus at WRC-2015
- Harmonisation of spectrum is key to the development of both satellite and terrestrial wireless telecommunications

AI 1.13 Additional Spectrum for IMT

WRC-15 – Future Agenda → WRC-19

AI 1.13

To consider identification of frequency bands for the future development of IMT including possible additional allocations, in accordance with Resolution 238

Candidate IMT Identifications (GHz)	Candidate IMT Identifications in new MS Allocations (GHz)
24.25–27.5	31.8–33.4
37.0–40.5	40.5–42.5
42.5–43.5	47.0–47.2
45.5–47	
47.2–50.2	
50.4–52.6	
66.0–76.0	
81.0–86.0	

- 36 GHz of spectrum have been identified at WRC-15 as candidate bands for further studies for 5G/IMT.
- Sufficient spectrum from which to find "more" spectrum for IMT/mobile/5G
- Important to consider ONLY these bands, which were identified on the basis of global consensus at WRC-2015.
- Global harmonization of spectrum is key to the development of satellite and terrestrial wireless telecommunications

GSC General Position

- There is a need for access to sufficient spectrum for connectivity for terrestrial and satellite broadband services.
- Respect WRC-15 decision, by remaining within candidate bands specified in Resolution 238.
- There is a need for continued, sustainable and viable access for broadband FSS services for current and future earth station utilization of the 24.25--27.5 GHz bands, and in both directions in appropriate parts of 40/50 GHz, without undue geographical or technical constraints.
  - FSS needs access to sufficient core broadband spectrum for *ubiquitous* user terminals – this cannot be shared with IMT.
  - FSS also needs access to broadband spectrum for *individually licensed* earth stations. This can be shared but there must be reasonable measures to ensure also future deployment of the FSS services.
- There is a real potential for interference from IMT transmitters in the mm wave bands into satellite receivers. Need to adopt measures for protection of the FSS from IMT operations in bands that are identified for IMT by WRC-19.
- IMT identification *should* be harmonized on a global (*for example,* 26 GHz, 66 GHz) or ITU-R Region basis (*for example* 40 GHz), *as appropriate*, and only bands expected to be used for IMT should be identified. This will give the technical and regulatory certainty required for investment and deployment of global broadband satellites systems.
- Support identification for IMT in the bands as discussed below.

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AI 1.13 Additional spectrum for IMT

GSC Position: Band 24.25-27.5 GHz (band A)

- An identification for IMT in the band 24.25-27.5 GHz is possible with appropriate regulatory measures to protection and enable sustainable, viable access for FSS and other space service operations.

  CPM text: *Method A2 (either Alternative 1 or 2) for IMT identification with the following conditions (and ITU-R Resolution [A113-IMT 26 GHZ] (WRC-19)).*

Measures for FSS and ISS space stations in the band 24.25-27.5 GHz

- To limit the aggregate IMT interference into FSS space receivers through the introduction in the RR of a limit on the Total Radiated Power (TRP) for IMT base station of 37 dBm/200 MHz. Furthermore, with the conditions that the main beam of IMT base stations should not point above the horizon. Such limit on IMT base stations would not put any undue constraints on IMT deployment (12 dB higher than maximum level from WP5D).

  CPM text: *Condition A2e Option 3 with 37 dBm/200 MHz. Also Condition A2g Option 3 or 4 (Monitoring of IMT characteristics including deployment) is supported.*

Measures for transmitting FSS earth stations

- The band is to be used for individually licensed FSS Earth stations at known locations (for example. gateways), therefore appropriate zones around FSS Earth stations where IMT base stations could potentially receive interference can be determined, and co-existence be ensured.
- Need to adopt provisions to enable deployment of future FSS earth stations.

  CPM text: *Condition A2d Option 1.*

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AI 1.13 Additional spectrum for IMT

GSC Position: Band 37 – 43.5 GHz (bands C, D and E)

- Current HDFSS identifications as per table below should be preserved.
- Need for connectivity for both terrestrial and satellite: FSS needs access to sufficient and sustainable spectrum for deployment of ubiquitous user terminals, notably in the bands identified for HDFSS (i.e. High-Density FSS, as per footnote RR5.516B), These, and other bands where ubiquitous user terminals will be deployed, cannot be shared with IMT.
- Provisions should be adopted to enable the deployment of future FSS earth stations (both user terminals and individually licensed earth stations).

	37-39.5 GHz	39.5-40	40-40.5	40.5-42 GHz	42-43.5 GHz
Region 1		HDFSS			
Region 2			HDFSS		
Region 3			HDFSS		

- For example CEPT has prioritized the band 40.5-43.5 GHz for IMT whereas several CITEL countries have prioritized the band 37-40 GHz for IMT, and some R2 administrations, including the USA, have also prioritized 40-42 GHz for satellite use including HDFSS.
- Bands should not be identified for IMT in a Region where it is not foreseen, or where it is known to not be feasible, to deploy IMT in practice.

AI 1.13 Additional spectrum for IMT

GSC Position: Band 37 – 43.5 GHz (bands C, D and E) (con't)

- IMT identification in the range as per the table below would provide 3 GHz of spectrum for IMT in all ITU Regions and would allow common IMT equipment to be used, provided the RF equipment can tune across the whole 37-43.5 GHz range.

	37-39.5 GHz	39.5-40	40-40.5	40.5-43.5 GHz
Region 1	No change	No change		IMT
Region 2	IMT		No change	
Region 3	No change	No change		IMT

- **Region 1:** IMT identification in 40.5-43.5 GHz on the basis of sharing with individually licensed FSS earth stations, that preserves current HDFSS identification in 39.5-40.5 GHz.
- **Region 2:** IMT identification in 37-40 GHz on the basis of sharing with individually licensed FSS earth stations, and which preserves current HDFSS identifications in 40-42 GHz and provides protections for user terminal use.
- **Region 3:** IMT identification in 40.5-43.5 GHz on the basis of sharing with individually licensed FSS earth stations, that preserves current HDFSS identifications in 40-40.5 GHz, harmonized with Region 1.

AI 1.13 Additional spectrum for IMT

GSC Position: Band 37 – 40.5 GHz (band C)

IMT identification in 37-40 GHz in ITU-R Region 2

- An identification for IMT in the band 37-40 GHz is possible in ITU-R Region 2 with appropriate regulatory measures to protection and enable sustainable, viable access for the FSS.

  CPM text: *Method C2 (either Alternative 1 or 2), for IMT identification limited to the band 37-40 GHz* in Region 2, and with the conditions below *(*in ITU-R *Resolution [B113-IMT 40/50 GHZ] (WRC-19)*).

  Note that to allow for FSS user terminals in the range 37 – 43.5 GHz, the GSC position in Region 2 for the band 40 - 40.5 GHz and in Regions 1 and 3 for the band 37- 40.5 GHz is NOC (Method C1).

Measures for receiving FSS earth stations in the band 37-40 GHz in ITU-R Region 2

- The band is to be used for individually licensed FSS Earth stations at known locations (for example gateways), therefore appropriate zones around FSS Earth stations where these stations could potentially receive interference can be determined, and co-existence be ensured.
- Need to adopt provisions to enable deployment of future FSS earth stations.

  CPM text: *Condition C2b Option 1.*

AI 1.13 Additional spectrum for IMT

GSC Position: Band 40.5 – 42.5 GHz (band D)

IMT identification in 40.5-42.5 GHz in ITU-R Regions 1 and 3

- An identification for IMT in the band 40.5-42.5 GHz is possible in ITU-R Regions 1 and 3 with appropriate regulatory measures to protection and enable sustainable, viable access for the FSS.

  CPM text: Method D2 (either Alternative 1 or 2), for IMT identification limited to the band 40.5-42.5 GHz in R1 and R3, and with the conditions below (in ITU-R Resolution [B113-IMT 40/50 GHZ] (WRC-19)).

  Note that to allow for FSS user terminals in the range 37 – 43.5 GHz, the GSC position in Region 2 for the band 40.5 - 42.5 GHz is NOC (Method D1)

Measures for receiving FSS earth stations in the band 40.5 - 42.5 GHz in ITU-R Regions 1 and 3

- The band is to be used for individually licensed FSS Earth stations at known locations (for example gateways), therefore appropriate zones around FSS Earth stations where these stations could potentially receive interference can be determined, and co-existence be ensured.
- Need to adopt provisions to enable deployment of future FSS earth stations.

  CPM text: *Condition D2a Option 1.*

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AI 1.13 Additional spectrum for IMT

GSC Position: Band 42.5 – 43.5 GHz (band E)

IMT identification in 42.5-43.5 GHz in Regions 1 and 3

- An identification for IMT in the band 42.5-43.5 GHz is possible in ITU-R Region 1 and 3 with appropriate regulatory measures to protection and enable sustainable, viable access for the FSS.

  CPM text: *Method E2 (either Alternative 1 or 2) for IMT identification limited to the band 42.5-43.5 GHz in R1 and R3, and with the conditions below (in ITU-R Resolution [B113-IMT 40/50 GHZ] (WRC-19)).*

  Note that to allow for FSS user terminals in the range 37 – 43.5 GHz, the GSC position in Region 2 for the band 42.5 - 43.5 GHz is NOC (Method E1)

Measures for FSS space stations in the band 42.5 - 43.5 GHz in ITU-R Regions 1 and 3

- To limit the aggregate IMT interference into FSS space receivers through the introduction in the RR of a limit on the Total Radiated Power (TRP) for IMT base station of 40 dBm/200 MHz. Furthermore, the main beam of IMT base stations should not point above the horizon. Such limit on IMT base stations would not put any undue constraints on IMT deployment (15dB higher than maximum level from WP5D).

  CPM text: *Condition E2a Option 2 with 44 dBm/200 MHz. Also Condition E2c Option 3 or 4 (Monitoring of IMT characteristics including deployment) is supported.*

Measures for transmitting FSS earth stations in the band 42.5 - 43.5 GHz in ITU-R Regions 1 and 3

- The band is to be used for individually licensed FSS Earth stations at known locations (for example. gateways), therefore appropriate zones around FSS Earth stations where IMT base stations could potentially receive interference can be determined, and co-existence be ensured.
- Need to adopt provisions to enable deployment of future FSS earth stations.
- *E2d Option 1*

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AI 1.13 Additional spectrum for IMT

GSC Position: Bands 47.2-50.2 GHz (band H) and 50.4-52.6 GHz (band I)

Already large amounts of spectrum are supported for IMT identification in the bands 24.25-27.5 GHz globally, 40.5-43.5 GHz in R1 and R3 and 37-40 GHz in R2, and 66-71 GHz globally. There is limited interest for IMT at 50 GHz, IMT and HDFSS (5.516B) are not compatible, hence no change to the RR in the bands 47.2 –50.2 GHz and 50.4-52.6 GHz is recommended.

The U.S. has designated the 48.2-50.2 GHz band for satellite use, including HDFSS.

If however IMT identifications in the band 47.2 –50.2 GHz and 50.4-52.6 are considered appropriate by WRC-19, protection measures similar to the ones in the band 42.5-43.5 GHz should be adopted, for both gateways and user terminals, as appropriate.

GSC Position: Bands 66-71 GHz (band J), 71-76 GHz (band K), and 81-86 GHz (L)

- IMT identification through Method J2 (either alternative 1 or 2) with the conditions of ITU-R Resolution [C113-IMT 66/71GHZ] (WRC-19), Methods K2 and L2 (either alternative 1 or 2) with the conditions of ITU-R Resolution [E113-IMT 70/80GHZ] (WRC-19).

GSC Position: Recommendations and Conclusions

- Focus should be on IMT identification in the bands:
  - 24.25-27.5 GHz (Globally)
  - 37-40 GHz in ITU Region 2, 40.5-43.5 GHz in ITU Regions 1 and 3.
  - 66-71 GHz (Globally)

  with appropriate regulatory measures for the protection of satellite services in a Resolution referenced in the footnotes.

- No bands outside those in Resolution 238 (WRC-15) should be considered

Summary of Methods and Options (CPM text) supported by GSC for AI1.13

Band	IMT-2020	Draft CPM Text
24.25-27.5 GHz (Band A)	Yes	Method A2 (Alternative 1 or 2), subject to: • Condition A2d Option 1 • Condition A2e Option 3 (with 37 dBm/200 MHz) • Condition A2g Option 3 or 4 Draft ITU-R Resolution [A113-IMT 26 GHZ] (WRC-19)
31.8-33.4 GHz (Band B)	No	Method B1 (No Change)
37.0-40.5 GHz (Band C)	Yes in Region 2 except in 40-40.5 GHz No in Regions 1 and 3	• In Region 1: Method C1 (NOC). • In Region 2, Method C2, Conditions C2b Option 1 for the band 37-40 GHz and C1 (NOC) for the band 40-40.5 GHz. • In Region 3: Method C1 (NOC). Draft ITU-R Resolution [B113-IMT 40/50GHZ]
40.5-42.5 GHz (Band D)	Yes in Regions 1 and 3 No in Region 2	• In Region 1: Method D2, Conditions D2a Option 1. • In Region 2: Method D1 (NOC), • In Region 3: Method D2, Conditions D2a Option 1. Draft ITU-R Resolution [B113-IMT 40/50GHZ]

42.5-43.5 GHz (Band E)	Yes in Regions 1 and 3
	No in Region 2
		• In Region 1: Method E2, with conditions below:
		• In Region 2: Method E1 (NOC),
		• In Region 3: Method E2, with conditions below:
		  ○ Condition E2a Option 2 (with 40 dBm/200 MHz)
		  ○ Condition E2c Option 3 or 4
		  ○ Condition E2d Option 1
		Draft ITU-R Resolution [B113-IMT 40/50GHZ]

45.5-47.2 GHz (Bands F and G)	No	Method F1 and G1 (No Change)
47.2-50.2 GHz (Band H)	No	Method H1 (No Change)

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Chapter 3: AI: 1.5,7,9.1.9

AI: 1.5 ESIMs in the FSS Ka-band

AI 1.5 ESIMs in the FSS Ka-band

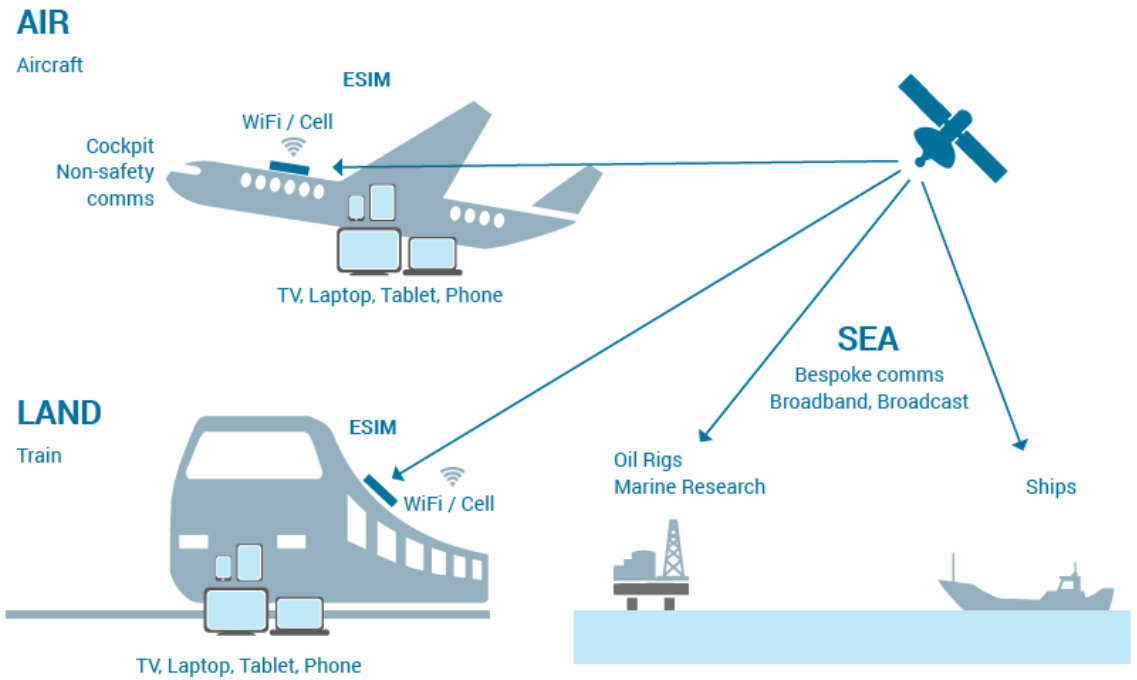
Commercial Connected Aircraft:

- 2017: 90 airlines => 7 400 aircraft
- 2027: 23 300 aircraft

Maritime Satcom Market:

- 2017: 337 300 terminals;
- 2027: 559 300 terminals.

Source: EUROCONSULT



Example top related queries:

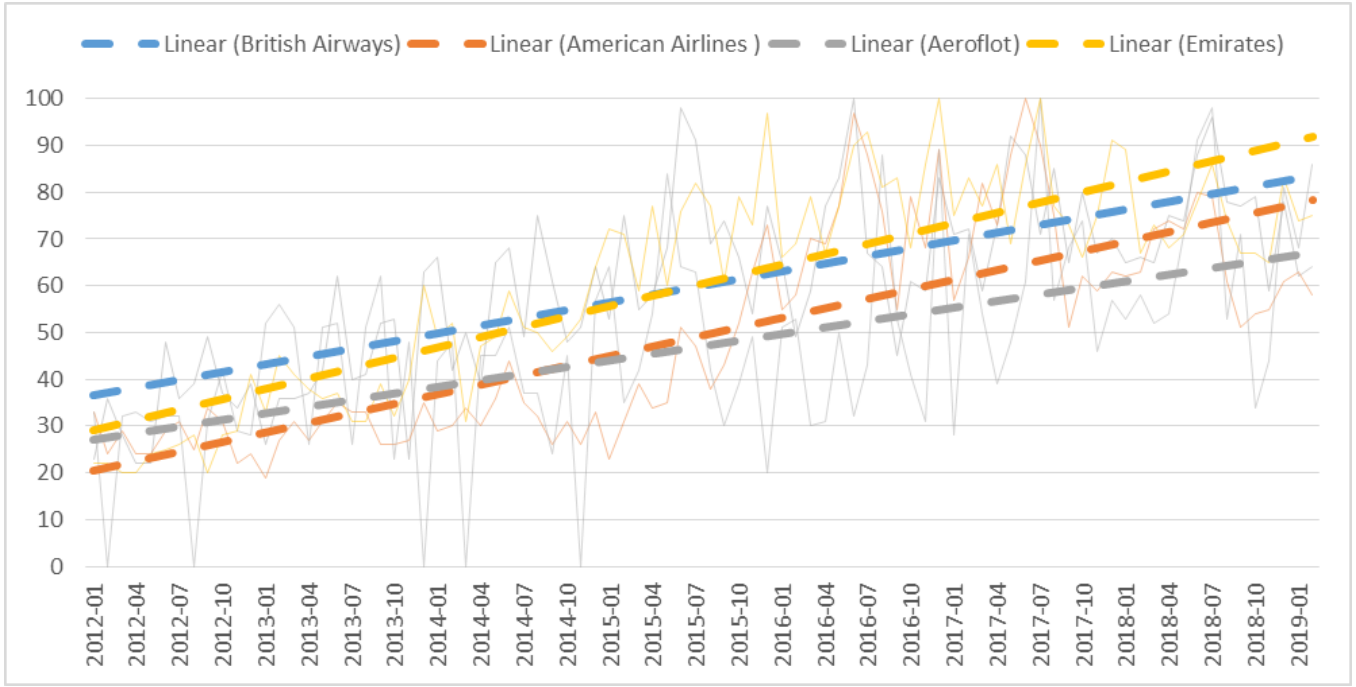
- **"Wifi on American Airlines"**
- **"Wifi on BA"**
- **"Does BA have wifi"**

Etc.

Market Survey:

- 67% would be more likely to rebook with an airline if inflight Wi-Fi were available;
  - 81% for passengers travelling with children;
  - 83% for business travellers;
- 54% agreed that they would not prefer to have Wi-Fi if it was poor quality.

Google trends (2012-2019) for "[airline] wifi" searches



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AI 1.5 ESIMs in the FSS Ka-band

Goal: To facilitate the operation of ESIMs in GSO FSS networks in the Ka-band

- **Genesis**: Resolution 158 (WRC-15)
- **Issue**: *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*

- **Background:** WRC-15 adopted provisions for ESIM operations within the FSS allocation in the 19.7 – 20.2 GHz and 29.5 – 30 GHz bands subject to conditions in Resolution 156. Resolution 156 recognizes the need for global broadband mobile-satellite communications, and that some of this need could be met by allowing ESIMs to communicate with space stations of the fixed-satellite service (FSS)
- AI 1.5 of WRC-19 addresses operation of ESIMs beyond these bands to meet the increasing demand for broadband satellite communications with mobility
- Today many ESIMs are operating in the air, in the sea and on the land, and airlines in particular are seeking to provide gate-to-gate passenger connectivity.

GSC General Position: Establish provisions for aeronautical, maritime, and land ESIM operations within GSO FSS networks in the Bands 17.7-19.7GHz and 27.5-29.5GHz, subject to technical and regulatory protection mechanisms for existing FSS *operations* & other allocated services.

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AI 1.5 ESIMs in the FSS Ka-band

Background - Current status:

- **Resolution 158 of WRC-15 resolves to invite the ITU-R to:**
  1. To study the technical and operational characteristics and user requirements of ESIM and the requirement for flexible use of spectrum to provide ESIM services;

     Further information in: Sections 2 & 3 of WP4A preliminary draft new Report ITU-R S.[AGENDA ITEM 1.5] & Reports ITU-R S.2223 & S.2357-0
  2. To study sharing and compatibility between ESIM and current and planned stations of existing services allocated in the bands;

     Further information in: Section 4 of WP4A preliminary draft new Report ITU-R S.[AGENDA ITEM 1.5] as well as PDNRs S./M.[ESIM-MS], S./F.[ESIM-FS] and S.[ESIM]
  3. To develop technical conditions and regulatory provisions for the three types of ESIMs operation (Land, Maritime, Aero)

     Based on text developed by WP 4A, the CPM Report includes an example Resolution for WRC-19, which includes the regulatory framework for ESIM operation as well as measures to ensure protection of other services. Most of the Resolution has been agreed at CPM, but there are some provisions for which the views of different administrations are indicated as options.

GSC Position – technical conditions on ESIM operations (1)

- Support Method B to adopt a footnote in Article 5 and an associated Resolution that would define conditions for ESIM operations, including:
  - that ESIMs communicate with FSS satellites and operate within the envelope of the FSS network
  - that Maritime ESIMs that operate within 60-70 km distance of low water mark of a country are subject to the prior agreement of the concerned coastal State
  - that Aero ESIM that does not meet the following PFD mask at the surface of the Earth are subject to the prior agreement of the concerned State.

    $PFD(\delta) = -124.7$ (dBW/m^2/14 MHz) for $0° \leq \delta \leq 0.01°$

    $PFD(\delta) = -120.9+1.9 \cdot \log10(\delta)$ (dBW/m^2/14 MHz) for $0.01° \leq \delta \leq 0.3°$

    $PFD(\delta) = -116.2+11 \cdot \log10(\delta)$ (dBW/m^2/14 MHz) for $0.3° < \delta \leq 1°$

    $PFD(\delta) = -116.2+18 \cdot \log10(\delta)$ (dBW/m^2/14 MHz) for $1° < \delta \leq 2°$

    $PFD(\delta) = -117.9+23.7 \cdot \log10(\delta)$ (dBW/m^2/14 MHz) for $2° < \delta \leq 8°$

    $PFD(\delta) = -96.5$ (dBW/m^2/14 MHz) for $8° < \delta \leq 90.0°$
  - that ESIMs operating in 27.5-28.6 GHz band meet an off-axis EIRP mask outside 3 degrees of the GSO or a maximum ESIM transmit EIRP to protect NGSO FSS systems. If the ESIM cannot meet this off-axis EIRP mask, the maximum on-axis EIRP of 55 dBW for bandwidths up to 100 MHz should not be exceeded. For larger bandwidths, the on-axis EIRP may be increased proportionately

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AI 1.5 ESIMs in the FSS Ka-band

GSC Position – conditions on ESIM operations (2)

- The pfd mask is a hard limit protecting terrestrial services, where they are operating, which meets the requirement of Resolution 158. The pfd mask provides a level of certainty for operations of both ESIM and terrestrial services, and no further condition is necessary.
- An altitude limit is unnecessary, and is inherently in conflict with the ITU-R conclusion (WP 5A) that a pfd mask approach with multiple elevation angle limits is adequate to protect the mobile service.

Note: Iridium does not support the GSC position on ESIM use of 19.4-19.6 GHz and 29.1-29.3 GHz.

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AI 1.5 ESIMs in the FSS Ka-band

GSC Position – responsibility for ESIM operations

- The administration under whose satellite network the ESIM is operating should ensure that the ESIM operator has the capabilities to respect the technical conditions as defined for ESIM operations.
- For Aero or Maritime ESIMs operating in international territories, and in the case of suspected or reported interference, the ‘flagship’ administration should investigate the interference and identify the ESIM operator.
- The flagship administration should then work together with the administration under whose satellite network the ESIM is operating to take the actions required to remove the interference.

Note: flagship means the country responsible for registering this aircraft or ship.

Note: Iridium does not support the GSC position on ESIM use of 19.4-19.6 GHz and 29.1-29.3 GHz.

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AI 1.5 ESIMs in the FSS Ka-band

GSC Position - options in the example Resolution in the CPM Report

	Resolution part	Issue	GSC position
1	Resolves 1.1.4	Defining when ESIM can be associated with the existing GSO FSS network, i.e. only after recording the FSS network in the MIFR or during the CR/C stage	Support Option 2, allowing submission of ESIM characteristics during the CR/C stage
2	Resolves 1.1.6	Whether limits for protection of NGSO FSS should be applied (27.5-28.6 or 27.5-29.1 GHz)	TBD
3	Resolves 1.1.7	Whether limits are required to protect NGSO MSS feeder links	Support Option 2. No limits are necessary, interference issues are dealt with in the current coordination process
4	Resolves 1.2.2 and Resolves 1.2.3	Whether the provisions for protection of terrestrial services should include a requirement not to affect the future development of these services	Support View 1. Such a condition could lead to additional constraints on ESIM at any time in the future are therefore opposed.
5	Resolves 1.2.5	Whether the limits for protection of terrestrial services are deemed to ensure that unacceptable interference is not caused	Support Option 3. Meeting the pfd and distances limits ensures that unacceptable interference is not caused. Proposals for additional conditions to avoid causing interference could lead to additional constraints on ESIM at any time in the future are therefore not supported.
6	Annex 2, para 2.1	The values for the pfd mask to protect terrestrial services from aero ESIM	The Option 1 pfd mask provides adequate protection. The Option 2 mask overprotects terrestrial services and unnecessarily constrains aero-ESIM operations
7	Annex 2, para 2.2	The need for an altitude limit in addition to a pfd mask	Support Option 2. There is no need for an altitude limit. The pfd mask provides all the protection necessary and an altitude limit would unnecessarily constrain aero-ESIM operations.
8	Annex 3	The need for Annex 3	Support deletion as the main body of the Resolution now covers the content of Annex 3.

Note: Iridium does not support the GSC position on ESIM use of 19.4-19.6 GHz and 29.1-29.3 GHz.

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AI 7, 9.1.3

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AI 7: Space Service Regulatory Framework

GSC Purpose: To provide regulatory certainty & flexibility

Source: Resolution **86 (Rev. Marrakesh, 2002)**

Background: Technological evolution and identification of inconsistence requires routine review and revision of the regulatory framework applicable to space services in the RR.

There is a need for a stable and predictable regulatory framework for efficient and economical use of spectrum and orbit resources.

Ongoing process of continuous evolution thru AI 7 at successive Conferences is supported.

Review of provisions should aim at:

- Addressing specific detected inconsistencies &
- developing improved provisions with an emphasis on solving urgent problem;
- Increasing flexibility to access spectrum while protecting existing systems.

AI 7: Space Service Regulatory Framework

Space service regulatory framework

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.

Current status

- There are 13 sub-issues established in WP 4A under Agenda item 7, issues A – M
- Issue C contains 7 sub-issues in itself, C1-C7, making it 19 issues in Agenda item 7

Position:

- **GSC favours a stable and predictable regulatory framework for efficient and economical use of spectrum and orbit resources. Hence, GSC supports retaining the current process of continuing evolution at successive WRCs of the regime governing space services.**
- **GSC favours the review of any RR provision which can bring accurate solutions to specific detected inconsistencies and develop new improved provisions with emphasis on solving the most urgent issues, i.e. well characterized issues whose improvement is urgent and impacting.**

AI: 9.1.3 NGSOs System in the C-Band

GSC Purpose: To provide regulatory certainty & flexibility

Source: Resolution **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*

Position:

- **GSC supports No Change to the Radio Regulations on this issue, as ITU-R studies have shown that circular-orbit non-GSO FSS operations used for global broadband services in the examined bands could result in large exceedances when tested against Recommendation ITU-R S.1323 protection requirements to ensure compatibility of non-GSO operations with GSO networks.**

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WRC-15 Outcome: C-Band

C-Band

- Vital + valuable for Asia
- Conventional C-Band mostly preserved at WRC-15

- 3400 - 3600 MHz almost global identification for IMT
- 3600 - 3700 MHz identified for IMT in 4 CITEL countries only
- 3700 - 4200 MHz preserved for FSS globally
- Mobile services remain secondary in 3800 - 4200 MHz globally
- ITU studies clearly show that sharing between IMT and FSS in C-band is not feasible.

- Mobile industry now has 200 MHz of globally identified spectrum for IMT
- APT Region was instrumental in preserving C-band, allowing vital continuity and growth of C-Band services in Asia-Pacific
- The ITU WRC-15 outcome needs to be respected to ensure regulatory certainty and harmonization

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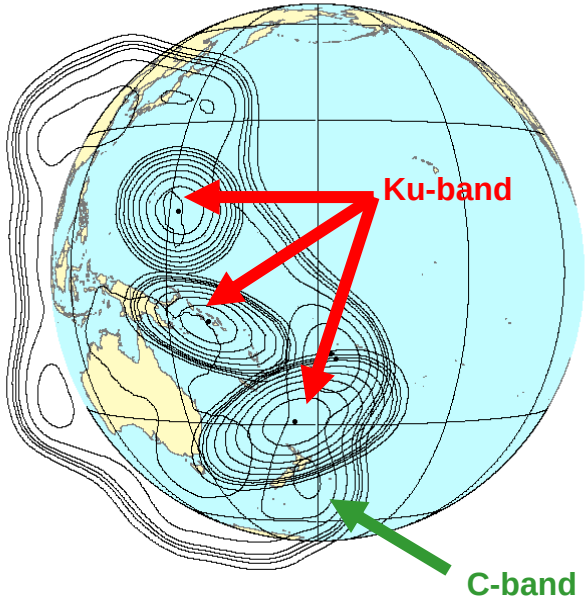
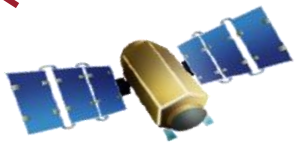
Why C-Band Remains a Mainstay?

- **Wide coverage**
  - Large beams allow economically viable coverage in low density areas for intercontinental + global communications
- **Propagation characteristics**
  - High availability even in high-rain zones
- **Availability**
  - Over 180 satellite deployed globally + NextGen satellites
- **Reliability**
  - 99.9% reliability in Asia -v- fibre which is often at 80% in Asia



Unique advantages of C-band cannot be replicated in other satellite bands or via terrestrial comms

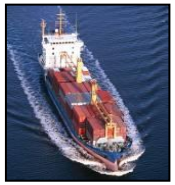
C-band Satellite User Groups



C-band

Wireless Extension Services

Corporate Networks



Maritime Communications

Aviation Security

Telemedicine

BBC WORLD SERVICE

BBC World Service

Distance Education

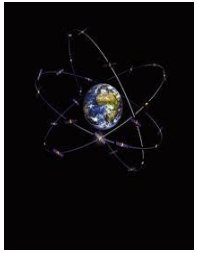
UNHCR The UN Refugee Agency

Internet Connectivity

Peace Keeping

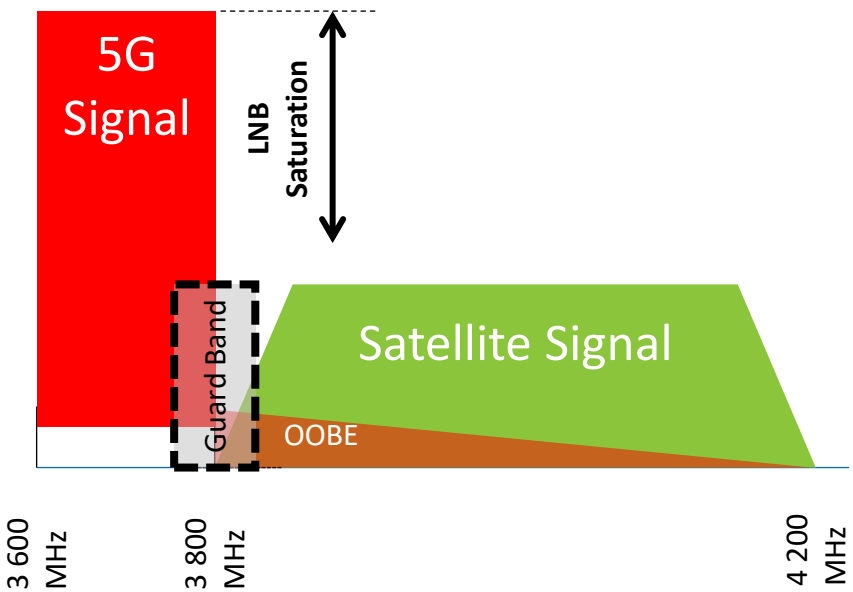
TV contribution

Disaster Preparedness



Galileo (GDDN)

Interference Mechanisms of 5G into C-Band FSS



- Satellite earth stations are very sensitive terrestrial interference.
- 5G signals are considerably more powerful than satellite signals.
- 5G signals can interfere with FSS receive earth stations in two ways:
  - Saturate the LNB of the earth station, even if the RF signal is adjacent to the satellite signal; and
  - Out-of-Band-Emissions (OOBE) of the 5G signal can cause in-band interference to FSS signals.
- Currently, OOBE levels specified in 3GPP standards do not protect FSS signals in adjacent bands.
- Using a guard band and imposing strict OOBE levels on 5G are required.

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4 simple reasons for NOT implementing 5G above 3600 MHz

1. Interference will prevent emergency/humanitarian services that rely on C-band
2. Hundreds of millions of people worldwide depend on C band for broadcasting news, sports + entertainment
3. C-band is the most reliable signal during heavy rainfall
4. It is important for global harmonization that the APT remains aligned with the outcome of WRC-15

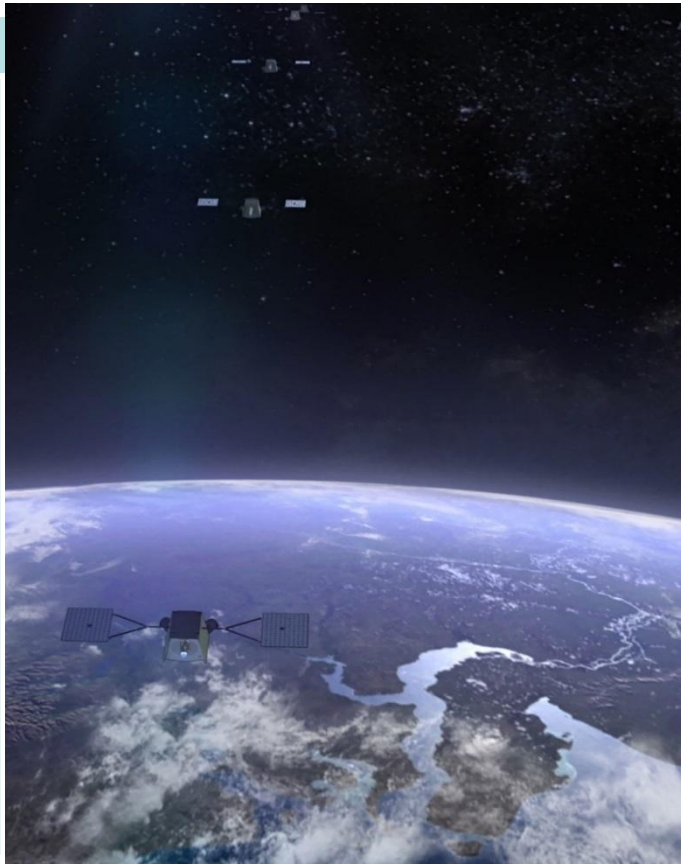
Sharing of C-band is not feasible due to the size of the needed exclusion zones and the large number of FSS earth stations that would need to be protected.

AI.9.1.9

AI: 9.1.9 New FSS uplink allocation in V band (51.4-52.4 GHz)

Purpose: Additional satellite spectrum

- Resolution **162 (WRC-15)** invites ITU-R to conduct studies considering additional spectrum needs for development of the FSS and conduct sharing and compatibility studies with existing services to determine the suitability 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.
- The spectrum needs were analysed by ITU-R (WP4A) and it was concluded that the additional FSS allocation being considered is beneficial to make broadband connections more accessible to communities regardless of their geographical location and with more affordable costs as achieved by HTS (High Throughput Satellite) systems.
- Regarding the sharing studies, it was concluded that the coexistence of FSS with existing services, including the adjacent band EEES passive services, would be feasible subject to appropriate conditions, these being reflected in the options in the draft CPM text produced by WP4A.



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AI 9.1.9 New FSS uplink allocation in V band (51.4-52.4 GHz)

Next generation High Throughput Satellite (HTS) systems will need to also operate in Q/V bands in order to address the increasing demand for broadband throughput and spectrum efficiency.

Currently planned HTS systems seek at least 5 GHz for uplink and downlink in the Q/V bands.

The 51.4 – 52.4 GHz band is contiguous with existing FSS uplink frequencies.

Recommends:

- Allocation of the band 51.4 – 52.4 GHz as Primary for Earth-to-space GSO feeder links, ensuring that this use will protect existing services, in the band and in adjacent bands, by applying the appropriate conditions under **Option 1A** of the draft CPM text
  - The allocation will be limited to feeder links operating with geostationary FSS networks.
  - FSS Earth stations shall operate with a minimum antenna diameter (e.g. 4.5 m.)
  - FSS Earth stations shall limit the unwanted emission power levels within the EESS (passive) band according to the conclusions of the studies, and these should be specified in the revision of Resolution 750 (Rev. WRC-15)

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Chapter 5: AI.1.8,1.10

(Inmarsat)

WRC-19 AI's
1.8(GMDSS) & 1.10 (GADSS)

AI: 1.8 GMDSS

1.8 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)**;*

Resolution 359 (Rev. WRC-15) *resolves (2)*:
*to consider regulatory provisions, if appropriate, based on the ITU-R studies, and taking into consideration the activities of IMO, related to the introduction of additional satellite systems into the GMDSS, including consideration of the MSS allocations used, **while ensuring the protection of all incumbent services, including those in adjacent frequency bands,** from harmful interference, as stated in recognizing e)*

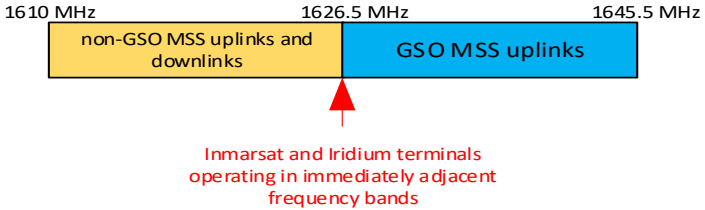
Resolution 359 (Rev. WRC-15) *considering e)*:
*"that GMDSS satellite systems need to provide protection of incumbent services in accordance with the Radio Regulations, including those in adjacent frequency bands, from harmful interference, and such **GMDSS satellite systems should operate within the interference environment of existing systems**."*

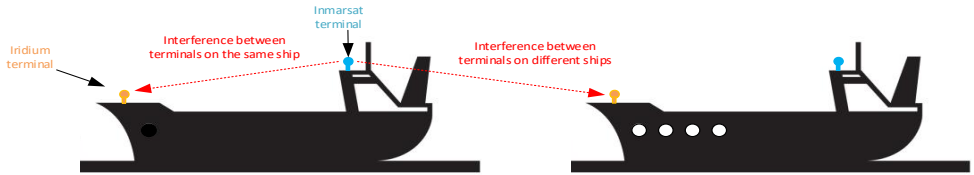
Resolution 359 (Rev. WRC-15) *recognizing c)*:

*"that due to the importance of GMDSS communication systems in ensuring the safe operation of shipping and commerce and security at sea, **they must be resilient to interference from existing systems**"*

AI: 1.8 GMDSS

Technical Considerations





- Inmarsat terminals could cause interference to Iridium receivers, in particular due to Iridium receiver overload. This type of interference has been reported in the past for land mobile terminals. However, Iridium and Inmarsat have co-existed for many years in adjacent bands within the existing interference environment.
- Iridium approval as a GMDSS provider introduces the risk of overload interference to Iridium GMDSS terminals from Inmarsat terminals on the same ship. In line with *considering e)* of Res 359, it would be Iridium's responsibility to manage this type of interference.
- From the technical perspective, Iridium terminals should be designed to be resilient to receiver overload (requires robust receiver filtering) and installations guidelines should ensure adequate separation between earth stations on a ship.
- New Additional Operator has previously sought constraints on Existing GMDSS operator regarding AMS(R)S, after achieving primary status;

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AI: 1.8 GMDSS

Technical Considerations

B1: Identify the New Additional Operator for GMDSS, but keep the downlink MSS allocation secondary.
B2: Either (a) To supplement Method B1 OR (b) To supplement Method B4 with a footnote that maintains the MSS downlink as secondary wrt MSS uplinks in the band 1626.5-1660.5 MHz. **Maritime regulatory Body IMO has NO objections to include this as footnote.**
B3: No Change
B4: Identify the Iridium bands for GMDSS, upgrading the MMSS downlink allocation to primary.

Changes to the RR to recognize New Additional Operator (Method B1 or B5) for GMDSS would raise the status of New Additional Operator downlinks – potentially allowing New Additional Operator to seek protection from interference from Existing Operator and put constraints on vessels operating with existing operator's terminal equipment;

IMO-ITU Joint Expert Working Group – although IMO has recognized new additional GMDSS provider in May 2018, the joint expert WG is still considering the impact and implications to the users in both existing and adjacent bands. IMO does not currently have a position on preferred method for AI 1.8.

- Both IMO and ITU are keen to ensure that existing GMDSS provider is NOT impacted in the adjacent band by the introduction of new additional GMDSS operator.

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AI: 1.8 GMDSS

Position

- Any new additional GMDSS provider now (or in the future) are welcomed, however, they must be fully compliant with the IMO Res 1001 (25) and in accordance with Res 359 ;
- For WRC-19, whichever Method (for instance Method B1 or B4) is chosen to recognize New Additional GMDSS Provider, it is important that "*additional regulatory text as provided under B2 is included within the method to ensure that New Additional GMDSS provider (s) continues to operate in the current interference environment and does not seek to constrain operations of existing provider.*"
- Proposed regulatory text in Method B2: *"Mobile earth stations receiving in the band 1610 – 1626.5 MHz shall not claim protection from mobile earth stations transmitting in the band 1626.5 – 1660.5 MHz."* **This text should be included as part of B1 or B4 option and reflected in a draft footnote in Article 5**.
- Administrations are kindly requested to support this proposal in WRC-19 preparations.

AI: 1.10 GADSS

1.10 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)**;

Developments

- No need for changes to the RR (Article 5) are necessary for GADSS requirements.
- Member State's development of proposal related to frequencies used for GADSS – allowing ICAO to choose the bands, rather than prescribing bands in the RR!

Discussion items and future action:

- Need to monitor proposals to ensure no list of GADSS frequencies in the RR.
- Modifications of RR (other than Article 5) to facilitate introduction of GADSS may be required.
- Any studies on regulatory provisions required for the implementation of GADSS should take into account the GADSS concept provided by ICAO.

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GADSS

Inmarsat ready

- Inmarsat “Swift Broadband Safety”, already capable of meeting GADSS requirements
- Using existing L-band MSS allocations and no change is necessary to the RR

Global Flight Tracking

Autonomous Distress Tracking

Flight Data Recovery

Session 14: Panel Discussions