

CHAPTER 5

Maritime, aeronautical and amateur services (Agenda items 1.1, 1.8, 1.9.1, 1.9.2, 1.10, 9.1 (issue 9.1.4))

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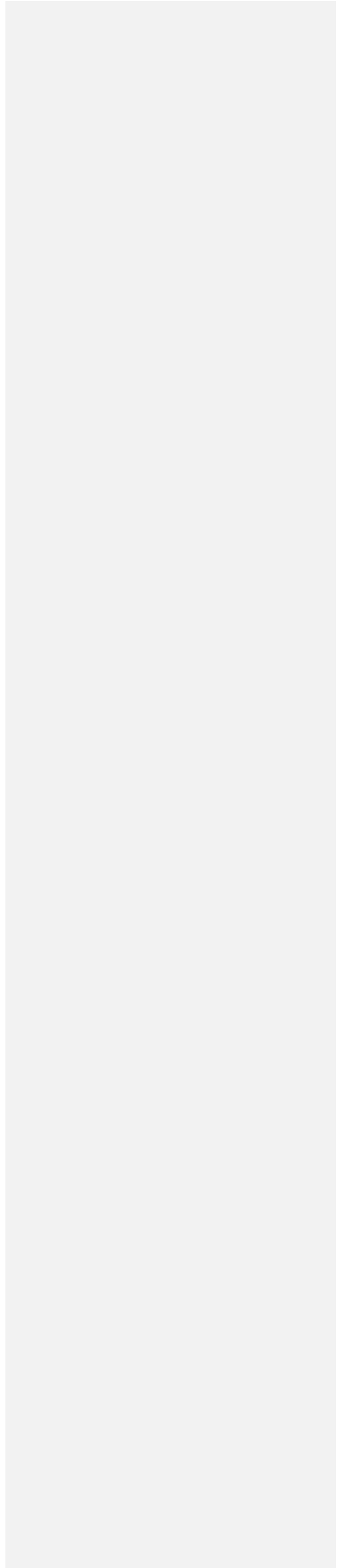
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Agenda item 1.1

(WP 5A / WP 5B, WP 5C, WP 6A, (WP 1A), (WP 3K), (WP 3M))

1.1 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);

Resolution 658 (WRC-15) – Allocation of the frequency band 50-54 MHz to the amateur service in Region 1

5/1.1/1 Executive summary

This agenda item addresses a possible new Region 1 allocation to the amateur service in the frequency band 50-54 MHz by full or partial worldwide harmonization with the existing 4 MHz primary allocations in Regions 2 and 3.

The spectrum needs for the amateur service has been quantified in two studies using an application-based approach. One of them indicates that 4 MHz of spectrum is required while the other indicates that 1.75 MHz is required.

Administrations in parts of Region 1 are party to the ST61¹ and GE89² Regional Agreements which remain in force in the band 50-54 MHz.

Studies have been undertaken to assess the possibility of sharing with the incumbent broadcasting, land mobile and radiolocation services. The studies have demonstrated that large separation distances are required for sharing with incumbent services. Furthermore, regulatory provisions will need to be implemented. Depending upon the incumbent service to be protected, the different protection distances and some measures can be found in Report ITU-R M.[AMATEUR_50_MHz].

Four methods are provided to satisfy the agenda item including the No Change method:

- **Method A:** An allocation to the amateur service on a primary basis in Region 1 in the band 50-54 MHz, or part thereof;
- **Method B:** An allocation to the amateur service on a secondary basis in Region 1 in the band 50-54 MHz, or part thereof (**Method B1**), or in the band 50 MHz–51.75 MHz (**Method B2**);
- **Method C:** An allocation to the amateur service in Region 1 on a partly primary and partly secondary basis in all or part of the frequency band 50-54 MHz;
- **Method D:** No changes in the frequency band 50-54 MHz.

Regulatory text is also provided for implementation of the proposed methods.

5/1.1/2 Background

In ITU Region 1, the frequency band 50-54 MHz is allocated to the broadcasting service on a primary basis, with additional or alternative allocations to the amateur, fixed, mobile, and/or radiolocation limited to wind profiler radars (WPR) services in some countries.

¹ Final Acts of the European Broadcasting Conference (Stockholm, 1961 as revised in Geneva, 2006) (“ST61”) in the European Broadcasting Area.

² Final Acts of the African Broadcasting Conference (Geneva, 1989 as revised in Geneva, 2006) (“GE89”) in the African Broadcasting Area and neighbouring countries.

The frequency band 47-68 MHz in most of Region 1 is governed by the ST61 and GE89 Regional Agreements, which remain in force. Noting that several countries in Region 1 were not party to the original agreements.

Noting that the frequency band 50-54 MHz is allocated to the amateur service on a primary basis in ITU Regions 2 and 3, full or partial worldwide harmonization of the allocation to the amateur service in the frequency band 50-54 MHz would enhance radio amateurs' global efforts to fulfil the purposes of the amateur service, which include self-training, technical investigations and intercommunication for a variety of purposes including communication in support of disaster relief.

5/1.1/3 Summary and analysis of the results of ITU-R studies

5/1.1/3.1 Spectrum needs

In considering the need for spectrum harmonization across the three regions, the required amount of spectrum for existing and future amateur applications needs to be calculated, taking into account the principles contained in Recommendation **34 (Rev.WRC-12)**.

An application-based approach, based on current usage of the 50-54 MHz frequency band in Regions 2 and 3, has been developed and agreed for calculating the spectrum needs for current and envisaged amateur applications in the 50-54 MHz frequency band. The results given by this application-based approach are strongly dependent upon the input parameters used. The parameters obtained through the spectrum occupancy analysis and contest log data are used in one study, while the parameters for another study are based on estimations.

Both studies considered the following applications: point-to-point single sideband (SSB) and frequency modulated (FM) voice transmission, FM voice repeater systems, wideband digital modes and infrastructure applications using a variety of transmission protocols.

In one study, the spectrum needs have been calculated for two different spectrum use situations: an average spectrum use occurring in about 98% of time (average day) and an exceptional intensive spectrum use (e.g., contest) occurring in about 2% of time.

Different parameters used for the spectrum needs calculations for each use case are derived through spectrum monitoring data analysis (only eight days in April 2018) as well as through the amateur contest data analysis (during June 2017 50 MHz contest of International Amateur Radio Union - IARU). The obtained results are representative for European countries with the average amateur population density of 0.117 stations/km². Table 5/1.1-1 summarizes the spectrum needs calculation results of that study.

TABLE 5/1.1-1

Spectrum needs for different combination of amateur applications and use cases based on spectrum occupancy measurements and log-data analysis

Required spectrum (kHz)		
Applications	Average use + 300% margin (98% of time)	Intensive use (2% of time)
SSB, FM, wideband	540	765
SSB, FM, wideband, repeaters	740	1 865**
SSB, FM, wideband, repeaters, infrastructure	1 240	4 865** 1 465*
* Infrastructure and repeaters are only considered in average cases.		
** The spectrum needs calculation regarding infrastructure and repeaters in the intensive use case assumes the same value for the fraction of active amateur stations using SSB; however, such a situation is unlikely to occur in practice and may need to be ignored.		

Another study uses the same applications-based approach, but using only estimated parameters based on long-term band usage patterns for SSB, FM, repeater and propagation beacon applications and extrapolated for future wideband applications (+) gives the spectrum needs shown in Table 5/1.1-2.

Using the parameters typical for the countries of European Conference of Postal and Telecommunications (CEPT), with an average population density of amateur licensees (0.07 stations/km²), the required spectrum is calculated to be slightly in excess of 4 MHz. Table 5/1.1-2 shows the estimated spectrum required for each of the applications.

TABLE 5/1.1-2

Spectrum needs for different amateur applications based on parameter estimation

Required spectrum (kHz)	
Applications	Average use (100% of time)
SSB	87
FM	25
Wideband modes ⁺⁺	500
Repeaters (FM)	950
Infrastructure ⁺⁺	2 500
Propagation beacons	100
Total for all applications	4 162

5/1.1/3.2 Sharing with the broadcasting service in Region 1

The transition to digital television broadcasting has significantly reduced the occupancy of the 50-54 MHz frequency band by the broadcasting service in ITU Region 1. However, the regional plans ST61 and GE89 still contain many frequency assignments in the frequency band 50-54 MHz and the Master International Frequency Register (MIFR) contains hundreds of records for broadcasting service transmitters in ITU Region 1.

Studies have shown that for protection of the broadcasting service from harmful interference, a field strength from an amateur station at the edge of the service area of a broadcasting transmitter shall not exceed 6 dB(μ V/m) for 10% of the time at a height of 10 m above ground. Typical separation distances between amateur service systems and broadcasting service stations would range from 70 to 175 km.

5/1.1/3.3 Sharing between the amateur service and the land mobile service in Region 1

For an interference protection ratio of $I/N = -6$ dB, studies have shown that for protection of the land mobile service from harmful interference, a separation distance in the range of 170 km to more than 500 km in average terrain is needed. In mountainous regions, the separation distances are in about the same range. Dependent on the amateur service application, interference from a single amateur station may simultaneously interfere with more than 25 mobile channels in a range of up to 170 km. Given the mobile nature of governmental communication systems, new and existing amateur service applications (fixed, mobile or portable) using the frequency band of 50-54 MHz, make sharing difficult.

One study has shown that some amateur service applications, such as repeaters (in high activity situations) and new infrastructure will generate harmful interference into the mobile service if operated in the frequency band 50-54 MHz. However, some other amateur service applications, such as SSB, FM, wideband modes and repeaters (in low activity situations), could share the band 50-54 MHz with the mobile service under specific operational conditions. It was further calculated that the spectrum needs for SSB, FM, wideband modes and repeaters in the band 50-54 MHz could be satisfied within 1.75 MHz. Therefore, in view of *invites* 1 and 2 of Resolution **658 (WRC-15)**, this study concludes that any spectrum allocation within the band 50-54 MHz for the amateur service should be limited to 1.75 MHz.

Monte-Carlo simulations conducted with no mitigation techniques have shown that the probability of interference is highly dependent on the usage density of the band by amateurs. For the SSB mode, it has been shown that the probability of harmful interference ranges between 8 and 86% given the number of active amateur channels considered in the simulation radius. For the FM mode, it is about 28%. For the wideband digital mode, the probability of interference is around 93% for the in-band case (affecting up to 20 land mobile channels) and decreases for the out-of-band emissions.

Interference mitigation measures such as coordination between services in adjacent countries, operational limitation on amateur stations; listen-before-talk operation and technical means such as spread spectrum techniques have not been studied as part of this agenda item.

5/1.1/3.4 Sharing between the amateur service and the radiolocation service (wind profiler radars)

Radio Regulations (RR) No. **5.162A** provides an additional allocation to the radiolocation service on a secondary basis in a number of countries, limited to the operation of wind profiler radars (WPR).

Studies show that typical separation distances between amateur service systems and wind profiler radars would range from 29 km to distances above 300 km, confirming the need for specific protection measures.

Taking into account the limited numbers of systems in or immediately adjacent to the frequency band 50-54 MHz range (and probably the expected low number of amateur systems in the vicinity of WPR installations), sharing could probably be considered on a case-by-case basis e.g. coordination zones established in affected geographical areas.

It has to be noted that this approach, currently, could only be possible and efficient if appropriate regulatory measures in the Radio Regulations ensure that amateur and radiolocation services are of equal status within the 50-54 MHz band.

5/1.1/3.5 Relevant ITU-R Recommendations

Recommendations ITU-R [M.1634-0](#), [M.1651-0](#), [M.1732-2](#), [M.1825-0](#), [P.526-14](#), [P.1546-5](#), [P.2001-2](#), [SM.851-1](#), [SM.1055-0](#), [BT.1368-13](#), [BT.2033-1](#).

5/1.1/3.6 Relevant ITU-R Reports

WDPDN Report ITU-R M.[AMATEUR_50_MHz], Report ITU-R [BT.2387-0](#).

5/1.1/4 Methods to satisfy the agenda item

Four methods are proposed to satisfy the agenda item and all of them involve suppression of Resolution **658 (WRC-15)**.

[Note: CPM19-2 is invited to consider whether to maintain the advantages and disadvantages for each method, taking into account that those might not be present in the draft CPM text for other agenda items.]

5/1.1/4.1 Method A

An allocation to the amateur service on a primary basis in all the band 50-54 MHz, or part thereof, with appropriate footnotes to provide protection to services which already have an allocation in the band.

Advantages:

- The requirement of the amateur service to have an allocation in the frequency band 50-54 MHz in Region 1 would be partly or fully satisfied.
- Partial or full harmonization of spectrum throughout the three ITU regions would be achieved for the amateur service, thus the principles outlined in Recommendation **34 (Rev.WRC-12)** would be respected.

Disadvantages:

- Administrations may need to adopt specific measures or develop multilateral agreements to ensure harmful interference is not caused to stations of incumbent services operated within their territory or in neighbouring territories.
- The amateur service could cause harmful interference to incumbent services which may be difficult to resolve.
- Regarding the radiolocation service, the sharing approach proposed may not be fulfilled.
- May affect current and future usage of the band.

5/1.1/4.2 Method B1

An allocation to the amateur service on a secondary basis in all or part of the frequency band 50-54 MHz, with appropriate footnotes or appropriate regulatory text to provide protection to services which already have an allocation in the band.

Advantages:

- The requirement of the amateur service to have an allocation in the frequency band 50-54 MHz in Region 1 would be fully or partly satisfied.

- Full or partial harmonization of spectrum throughout the three RR Regions would be achieved, thus the principles outlined in Recommendation **34 (Rev.WRC-12)** would be respected.
- Incumbent services with a primary allocation remain protected and does not place constraints on the secondary incumbent services.

Disadvantages:

- Full harmonization of spectrum for the amateur service throughout the three RR Regions would not be achieved in terms of service status.
- If the amateur service has secondary status, future introduction of new primary services into the band or modification to RR Article **5** covering all or part of the 50-54 MHz frequency band may adversely impact the amateur service.

5/1.1/4.3 Method B2

An allocation to the amateur service on a secondary basis in the frequency band 50-51.75 MHz, with appropriate footnotes to provide protection to services which already have an allocation in the band.

Advantages:

- The spectrum needs of the amateur service in the frequency band 50-54 MHz in Region 1 would be satisfied according to one study.
- Partial harmonization of spectrum throughout the three RR Regions would be achieved, thus the principles outlined in Recommendation **34 (Rev.WRC-12)** would be respected.
- Incumbent services with a primary allocation remain protected and does not place constraints on the secondary incumbent services.

Disadvantages:

- The spectrum needs of the amateur service in the frequency band 50-54 MHz in Region 1 would be only partly satisfied according to another study.
- Full harmonization of spectrum for the amateur service throughout the three RR Regions would not be achieved in terms of service status.
- If the amateur service has secondary status, future introduction of new primary services into the band or modification to RR Article **5** covering all or part of the 50-54 MHz frequency band may adversely impact the amateur service.

5/1.1/4.4 Method C

An allocation to the amateur service on a partly primary and partly secondary basis in all or part of the frequency band 50-54 MHz, with appropriate footnotes to provide protection to services which already have an allocation in the band.

Advantages:

- The requirement of the amateur service to have an allocation in the frequency band 50-54 MHz in Region 1 would be fully or partially satisfied.
- Partial harmonization of spectrum throughout the three ITU regions would be achieved, thus the principles outlined in Recommendation **34 (Rev.WRC-12)** would be fully or partially respected.
- The use of RR No. **4.4** for implementing spectrum allocations on a national or multinational basis may be avoided.

Disadvantages:

- The needs of the amateur service in the frequency band 50-54 MHz in Region 1 for spectrum and spectrum harmonization may only be partly satisfied.
- Administrations may need to adopt specific measures, or develop multilateral agreements to ensure harmful interference is not caused to stations of incumbent services (which may be difficult to resolve) operating within their territory or in neighbouring territories.
- Regarding the radiolocation service, the sharing approach proposed may not be fulfilled.
- May affect current and future usage of the band.

5/1.1/4.5 Method D

Method D is to not make any changes (No Change) in the frequency band 50-54 MHz.

Advantage:

- Avoid additional restrictions on the operations of broadcasting, radiolocation, land mobile and fixed services stations and avoid possible interference from the amateur service.

Disadvantage:

- Does not satisfy the requirements of the amateur service.

5/1.1/5 Regulatory and procedural considerations

5/1.1/5.1 For all Methods A, B1, B2, C, and D, suppression of Resolution 658 (WRC-15)

SUP

RESOLUTION 658 (WRC-15)

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

5/1.1/5.2 For Method A

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

47-75.2 MHz

Allocation to services		
Region 1	Region 2	Region 3
<p>47-68.50 BROADCASTING</p> <p>5.162A 5.163 5.164 5.165 5.169-5.174</p>	<p>47-50 FIXED MOBILE</p>	<p>47-50 FIXED MOBILE BROADCASTING</p> <p>5.162A</p>
<p>4750-685[x] AMATEUR BROADCASTING 5.162A-5.163 5.164 5.165 5.169-5.174 <u>ADD 5.A11</u> <u>ADD 5.B11</u></p>	<p>50-54 AMATEUR</p> <p>5.162A 5.167 5.167A 5.168 5.170</p>	
<p>475[x]-68 BROADCASTING</p> <p>5.162A 5.163 5.164 5.165 [5.169] 5.171</p>	<p>54-68 BROADCASTING Fixed Mobile</p> <p>5.172</p>	<p>54-68 FIXED MOBILE BROADCASTING</p> <p>5.162A</p>

ADD

5.A11 In Region 1 in the frequency band 50-5[x] MHz, with the exception of those countries listed in No. **5.169**, stations of the amateur service shall not cause harmful interference to, or claim protection from, stations of the broadcasting service. The administrations of neighbouring countries in Region 1 shall ensure that the field strength emitted by an amateur station does not exceed a calculated value of +6 dB(µV/m) at a height of 10 m above ground at the service area boundary of operational broadcasting stations for more than 10% of time, unless otherwise agreed between affected administrations. (WRC-19)

ADD

5.B11 In Region 1 in the frequency band 50-5[x] MHz with the exception of those countries listed in No. **5.169**, stations of the amateur service shall not cause harmful interference to, or claim protection from, stations of the mobile service and wind profiler radars operating in the radiolocation service. (See Resolution [**A11-WPR**] (**WRC-19**).) (WRC-19)

*[Note: The draft new Resolution [**A11-WPR**] (**WRC-19**) has not been developed yet and contributions to CPM19-2 are invited.]*

5/1.1/5.3 For Method B1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

47-75.2 MHz

Allocation to services		
Region 1	Region 2	Region 3
<p>47-6850 BROADCASTING</p> <p>5.162A 5.163 5.164 5.165 5.169-5.174</p>	<p>47-50 FIXED MOBILE</p>	<p>47-50 FIXED MOBILE BROADCASTING</p> <p>5.162A</p>
<p>4750-685[x] BROADCASTING <u>Amateur</u> 5.162A-5.163 5.164 5.165 5.169-5.174 <u>ADD 5.C11</u> <u>ADD 5.D11</u></p>	<p>50-54 AMATEUR</p> <p>5.162A 5.167 5.167A 5.168 5.170</p>	
<p>475[x]-68 BROADCASTING</p> <p>5.162A 5.163 5.164 5.165 5.169 5.171</p>	<p>54-68 BROADCASTING Fixed Mobile</p> <p>5.172</p>	<p>54-68 FIXED MOBILE BROADCASTING</p> <p>5.162A</p>

ADD

5.C11 Amateur stations in the band 50-5[x] MHz, with the exception of those countries listed in No. **5.169**, shall not cause harmful interference to, or claim protection from, existing or planned, broadcasting, mobile, fixed or wind profiler radars operating in the radiolocation service. (WRC-19)

ADD

5.D11 The use of frequencies within the frequency band 50-5[x] MHz by amateur stations with the exception of those countries listed in No. **5.169**, is subject to getting prior special authorization from the administration concerned, together with the agreement of other administrations, whose broadcasting service may be affected. To identify potentially affected administrations in Region 1 the field-strength value must be set to 6 dB(µV/m) at a height of 10 m above the ground for 10% of the time at the border of the territory of this administration. (WRC-19)

5/1.1/5.4 For Method B2

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD

47-75.2 MHz

Allocation to services		
Region 1	Region 2	Region 3
47-6850 BROADCASTING 5.162A 5.163 5.164 5.165 5.169-5.174	47-50 FIXED MOBILE	47-50 FIXED MOBILE BROADCASTING 5.162A
4750-6851.75 BROADCASTING <u>Amateur ADD 5.E11</u> 5.162A 5.163 -5.164 5.165 5.169-5.174	50-54 AMATEUR	
4751.75-6854 BROADCASTING 5.162A 5.163 -5.164 5.165 5.169-5.174	5.162A 5.167 5.167A 5.168 5.170	

4754-68 BROADCASTING 5.162A 5.163 5.164 5.165 5.169-5.171	54-68 BROADCASTING Fixed Mobile 5.172	54-68 FIXED MOBILE BROADCASTING 5.162A
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ADD

5.E11 *Additional allocations:* in countries not listed in No. **5.169** stations in the amateur service shall not cause harmful interference to other services to which this band is allocated. The operation of stations in the amateur service shall be subject to agreement obtained under No. **9.21** with respect to the broadcasting service. For identification of potentially affected administrations in Region 1 the field-strength value of 6 dB(μV/m) for 10% of the time produced at 10 m above ground level at the border of the territory of any other administration shall be used. (WRC-19)

5/1.1/5.5 For Method C

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

47-75.2 MHz

Allocation to services		
Region 1	Region 2	Region 3
47-6850 BROADCASTING 5.162A 5.163 5.164 5.165 5.169-5.171	47-50 FIXED MOBILE	47-50 FIXED MOBILE BROADCASTING 5.162A
4750-68 [xx] <u>AMATEUR</u> BROADCASTING 5.162A- 5.163 5.164 5.165 5.169- 5.171 <u>ADD 5.F11</u> <u>ADD 5.G11</u>	50-54 AMATEUR	

<p>47[xx]-68[<54] BROADCASTING <u>Amateur</u> 5.162A-5.163 5.164 5.165 5.169-5.171 <u>ADD 5.H11</u></p>	<p>5.162A 5.167 5.167A 5.168 5.170</p>	
<p>47[<54]-68 BROADCASTING 5.162A 5.163 5.164 5.165 [5.169] 5.171</p>	<p>54-68 BROADCASTING Fixed Mobile 5.172</p>	<p>54-68 FIXED MOBILE BROADCASTING 5.162A</p>

ADD

5.F11 In Region 1, in the frequency band 50-[xx] MHz, with the exception of those countries listed in No. **5.169**, stations in the amateur service shall not cause harmful interference to, or claim protection from, stations in the broadcasting service. The administrations of neighbouring countries in Region 1 shall ensure that the field strength emitted by an amateur station does not exceed a calculated value of +6 dB(µV/m) at a height of 10 m above ground at the service area boundary of operational broadcasting stations for more than 10% of time, unless otherwise agreed between affected administrations. (WRC-19)

ADD

5.G11 In Region 1, in the frequency band 50-[xx] MHz, with the exception of those countries listed in No. **5.169**, stations in the amateur service shall not cause harmful interference to, or claim protection from, stations in the mobile service and wind profiler radars operating in the radiolocation service. (See Resolution **[B11-WPR] (WRC-19)**.) (WRC-19)

*[Note: The draft new Resolution **[B11-WPR] (WRC-19)** has not been developed yet and contributions to CPM19-2 are invited.]*

ADD

5.H11 *Additional allocations:* frequencies in the frequency band [xx-< 54] MHz may be used by amateur service stations as a secondary allocation. The use of frequencies by amateur stations is subject to getting prior special permission from the appropriate authority, together with the agreement of other administrations, whose radio service may be affected. To identify potentially affected administrations in Region 1 the field-strength value must be set to 6 dB(µV/m) for 10% of the time at the border of the territory of any other administration. (WRC-19)

5/1.1/5.6 For Method D

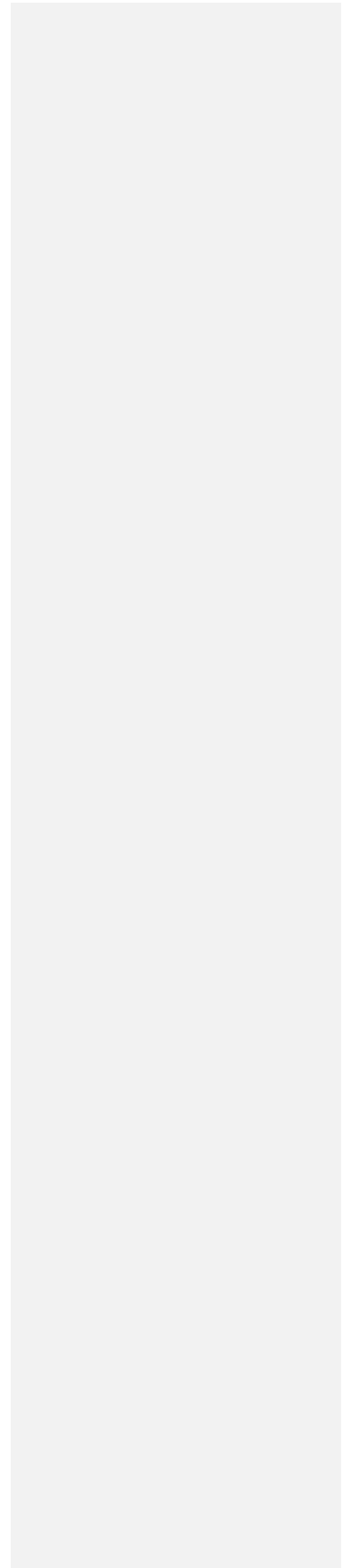
ARTICLE 5

Frequency allocations

**Section IV – Table of Frequency Allocations
(See No. 2.1)**

NOC

47-75.2 MHz



Agenda item 1.8

1.8 to consider possible regulatory actions to support Global Maritime Distress Safety System (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) – Consideration of regulatory provisions for updating and modernization of the Global Maritime Distress and Safety System

5/1.8/1 Executive summary

WRC-19 agenda item 1.8 encompasses two separate items. The first is global maritime distress and safety system (GMDSS) modernization addressed under *resolves to invite ITU-R 1* of Resolution 359 (Rev.WRC-15). In this chapter GMDSS modernization is referred to as “Issue A.” The second is the introduction of additional satellite systems into the GMDSS, covered under *resolves to invite ITU-R 2* of Resolution 359 (Rev.WRC-15). The introduction of an additional satellite system into the GMDSS is referred to as “Issue B.”

5/1.8/1.1 Resolution 359 (Rev.WRC-15), invites the 2019 World Radiocommunication Conference 1

To satisfy Issue A under WRC-19 agenda item 1.8, two methods are presented below to be reflected in the Radio Regulations. The first method is no change; the second method includes frequencies to be used for medium frequency (MF) and high frequency (HF) navigational data (NAVDAT) systems, in support of GMDSS modernization.

5/1.8/1.2 Resolution 359 (Rev.WRC-15), invites the 2019 World Radiocommunication Conference 2

To satisfy Issue B under WRC-19 agenda item 1.8, several methods are presented below to reflect in the Radio Regulations the frequencies used by a non-GSO GMDSS satellite system, noting that WRC-19 is invited to take into consideration the activities of International Maritime Organization (IMO).

5/1.8/2 Background

Agenda item 1.8 (Resolution 359 (Rev.WRC-15)), concerns GMDSS. *Resolves 1* addresses the modernization of the GMDSS while *resolves 2* addresses the introduction of additional satellite providers into the GMDSS.

5/1.8/2.1 Issue A: Global maritime distress and safety system modernization

The GMDSS was adopted as part of the 1988 amendments to the International Convention for the Safety of Life at Sea, 1974 (SOLAS). It was fully implemented in 1999. It has served the mariner and the maritime industry well since its inception, but some of the GMDSS technologies used have not reached their full potential, and some GMDSS functions could be performed by more modern technologies.

IMO has adopted a modernization plan for the GMDSS containing a high-level review and a detailed review. The detailed review and the plan show that the use of some existing services is declining. Meanwhile, some new technologies are considered to be possibly introduced in the modernized GMDSS, such as VHF data exchange system (VDES) and the NAVDAT system. The VDES has been already covered by WRC-15 for the terrestrial component and agenda item 1.9.2 covers the satellite component, therefore no action is requested for the VDES under agenda item 1.8.

Navigational text (NAVTEX) was incorporated into the regulations for the GMDSS for disseminating maritime safety information, which was introduced in a transitional phase from 1992 to 1999, after which it became mandatory under Chapter V of the SOLAS regulations.

In March 2012, ITU-R approved Recommendation ITU-R M.2010 “*Characteristics of a digital system, named Navigational Data for broadcasting maritime safety and security related information from shore-to-ship in the 500 kHz band*”. Later on, in April 2014, the other Recommendation ITU-R M.2058 “*Characteristics of a digital system, named navigational data for broadcasting maritime safety and security related information from shore-to-ship in the maritime HF frequency band*” was also approved. NAVDAT is counted as an enhancement of existing NAVTEX and could be considered as a potential entity in next generation of GMDSS.

WRC-12 addressed the allocation of the 495-505 kHz frequency band for the maritime mobile service. This band is regarded as the most suitable for MF NAVDAT application. However, regulatory provisions are still needed for both MF and HF NAVDAT applications.

5/1.8/2.2 Issue B: Introduction of additional satellite systems into the Global Maritime Distress and Safety System (resolves to invite ITU-R 2)

To date, only one satellite system has been incorporated by the IMO in the GMDSS “system of systems”. Noting *recognizing d*) of Resolution **359 (Rev.WRC-15)**, WRC-19 is invited to consider the ITU-R studies that may be undertaken as part of this agenda item (see section 5/1.8/1.2 above).

A compilation of related ITU-R Recommendations and Reports is given below.

5/1.8/3 Summary and analysis of the results of ITU-R studies

Existing relevant Recommendations and Report for Issue A:

Recommendations [ITU-R M.2010](#), [ITU-R M.2058](#), [ITU-R M.1798](#), [ITU-R P.368](#), Report [ITU-R M.2201](#).

Existing relevant Recommendations and Reports for Issue B:

Recommendations [ITU-R M.1184-2](#), [ITU-R M.1188-1](#), [ITU-R M.1583-1](#), [ITU-R RA.1631-0](#), Report [ITU-R M.2369-0](#), WDPDN Report ITU-R M.[GMDSS-SATREG], WDPDN Report ITU-R M.[RAS-COMPAT].

5/1.8/3.1 Issue A: Global maritime distress and safety system modernization (resolves to invite ITU-R 1)

IMO will approve the revision of SOLAS Chapters III and IV in 2022. For this reason, it will be important to keep on the agenda for WRC-23 the modernization of the GMDSS. However, some actions could be considered and taken for the WRC-19. The regulatory recognition of the frequencies for the MF and HF NAVDAT could facilitate the work during WRC-23. It will also help the administrations, given sufficient time, to make available those frequencies for the MF and HF NAVDAT.

NAVDAT is a kind of digital system for broadcasting maritime safety and security-related information from shore-to-ship. NAVDAT uses a time-slot allocation similar to the NAVTEX system which could be coordinated by IMO in the same manner. NAVDAT could operate in both MF and HF frequency bands. A 10 kHz channel is the necessary bandwidth for each system. The system uses OFDM which is a modulation technology for digital transmissions, and every subcarrier is modulated either in 64-QAM, 16-QAM or 4-QAM.

As the 500 kHz frequency band provides good coverage as shown in Recommendation ITU-R P.368-9, the frequency band 415-526.5 kHz of the maritime mobile service would be used for MF NAVDAT as described in Recommendation ITU-R M.2010.

The detailed review of GMDSS shows that the uses of HF narrowband direct printing (NBDP) for follow-up communications is declining greatly, and HF MSI could also be accomplished by means other than NBDP, such as HF NAVDAT. Six channels respectively in 4 MHz, 6 MHz, 8 MHz, 12 MHz, 16 MHz and 22 MHz frequency bands listed in RR Appendix 17 would be used for HF NAVDAT, as described in Recommendation ITU-R M.2058.

NAVDAT has the function of broadcasting message of safety of navigation, security, piracy, search and rescue, meteorological messages and piloting or harbour messages etc. There is a need to establish international harmonized standards, including technical and operational characteristics in detail, such as priority identification, protocol, message classification and data structure, etc. and necessary coordination schemes by IMO, and harmonized frequency band explicitly identified by the Radio Regulations. This will ensure the implementation of global NAVDAT application. This is very similar to the implementation of international NAVTEX service transmitting English language messages operating on 518 kHz.

On the other hand, as the high affectivity and efficiency, the NAVDAT system could also be used by national authorities for transmitting safety and security-related information in national languages or for some specific functions. This kind of national NAVDAT application might not operate in globally harmonized standards, for example, in different data structures, or in different frequency bands. The national NAVDAT systems will or need not meet the coordination schemes by IMO, depending on the frequency bands they use. This is very similar to NAVTEX transmitting local language messages operating on 490 kHz or other frequency bands specified by national authorities in accordance with the NAVTEX Manual.

Analyses on medium-frequency band

So far, NAVDAT is one of the most important potential elements involved both in GMDSS modernization and e-navigation. However, there is not any frequency band used for the application in the Radio Regulations. With respect to the frequency band 415-526.5 kHz, only the 495-505 kHz band is exclusively allocated in the maritime mobile service globally. Thus, this band would be the best choice for the international NAVDAT broadcasting.

Technically, the other parts of the frequency band 415-526.5 kHz are also suitable for the NAVDAT application. However, the use of these bands by the maritime mobile service is restricted for only radiotelegraphy according to RR No. 5.79. Practically, except the NAVTEX services, radiotelegraphy has been greatly declined to disuse in many countries. Allowing national NAVDAT systems using these bands for the maritime mobile service might be feasible. Some appropriate regulatory approach would give administrations an opportunity to promote the development and deployment of this kind of new advanced technology.

The further protection approaches will be considered during the implementation of GMDSS modernization as NAVDAT recognized in GMDSS, and the coordination scheme developed. This is planned to be done in the study cycle of WRC-23, according to the progress of activities of IMO.

Analyses on high-frequency band

WRC-12 designed some frequency bands in RR Appendix 17 for digitally modulated emissions in the maritime mobile service (e.g. as described in the most recent version of Recommendation ITU-R M.1798) from 1 January 2017 by footnote *p*). ITU-R issued Recommendation ITU-R M.2058-0 in February 2014. Six channels respectively within 4 MHz, 6 MHz, 8 MHz, 12 MHz, 16 MHz and 22 MHz frequency bands with footnote *p*) are recommended to be used for HF

NAVDAT. It is feasible technically. However, there are needs to take appropriate actions to give NAVDAT application regulatory status to operate in these bands. Furthermore, just as the same as the MF NAVDAT, the further protection approaches on HF bands need to be considered during the implementation of GMDSS modernization depending on the situation related to NAVDAT recognized in GMDSS, and the related coordination scheme developed. This is also planned to be done in the study cycle of WRC-23, according to the progress of activities of IMO.

Analysis of the Master International Frequency Register showed that the frequency bands suggested for implementation of the HF NAVDAT system were used by a large number of transmitting coastal stations in the maritime mobile service subject to existing spectrum allocations. Those stations could cause harmful interference to the operation of HF NAVDAT system ship receivers on a significant portion of the World Ocean. Therefore, effective implementation of HF NAVDAT systems would require appropriate development of regulatory and technical measures providing its compatibility with currently existing maritime mobile stations. Currently the NAVDAT system does not refer to internationally coordinated systems, adopted by IMO. Therefore, incorporation of HF NAVDAT system frequency bands into RR Appendix 15 seems inappropriate.

5.1.8/3.2 Issue B: Introduction of additional satellite systems into the Global Maritime Distress and Safety System (*resolves to invite ITU-R 2*)

There is currently one operating non-GSO MSS system being considered by the IMO which could provide worldwide operation of GMDSS within MSS allocations in the frequency range 1 616-1 626.5 MHz, including to Arctic and Antarctic areas.

This system was first published under special section RES46/C/40, BR IFIC 2081, and notified in BR IFIC 2418. The allocation used by this system is also used by other non-GSO and GSO MSS systems.

MSS satellite systems in the band 1 610-1 626.5 MHz are subject to frequency coordination under RR Article 9 as indicated in RR No. 5.364. Specifically RR No. 9.11A, together with the associated Rules of Procedure (RoP), calls for coordination between geostationary and non-geostationary satellite networks alike, and with other services having equal rights. The above-mentioned system's service links within this band (both uplink and downlink) having been coordinated under RR No. 9.11A with those services with equal status, notified and recorded under RR Article 11 in the Master International Frequency Register (MIFR). It is emphasized that today, apart from frequency overlap check, there is no established criteria to trigger coordination with other satellite networks. However, many coordinations have taken place and are taking place on the basis of frequency overlap. Consequently, successful application of RR No. 9.11A should not be construed as successful coordination similar to those foreseen under RR No. 9.7. It is also to be noted that the MSS downlinks are recorded as having secondary status.

Within the band 1 616-1 626.5 MHz the satellite system under consideration by IMO operates using the same frequency for both uplink and downlink, to each mobile earth station. A full description of this operation can be found in Report ITU-R M.2369.

Under the authorization issued by the notifying administration, the space stations of the satellite system are authorized to operate in the 1 618.725-1 626.5 MHz band, and on a shared basis with another non-GSO network under the responsibility of the same notifying administration in the 1 617.775-1 618.725 MHz band.

On this subject, two views were expressed:

- View 1: expressed that, because these assignments are operated using time division duplex (TDD), in which the subscriber units and satellites transmit and receive in the same frequency band, the secondary downlinks are effectively protected by the primary

uplink communication links and in practice enjoy the same rights in the 1 618.725-1 626.5 MHz band. There is no other operational MSS system which is co-frequency with the HIBLEO-2 system. From the practical perspective of the assignments and their protection, the unique operation of the HIBLEO-2 satellite uplink and downlink in the same frequency band (“time division duplex”), the date priority enjoyed by the HIBLEO-2 filing, and the primary allocation status of the uplink provide suitable protection for use of the frequencies in both directions.

- View 2: expressed that since synchronization and the channel assignments mentioned above are managed by the satellite, it is vital for the function of this system that the downlink can be received without interruption, something that cannot be ensured with a secondary allocation. Moreover, the operation of this satellite system downlink has a status of “non-interference, non-protection” vis-à-vis any primary service within the same band and in adjacent bands, and since there is currently no reliable coordination criteria, apart from frequency overlap which is one among other interference criteria, to accomplish coordination, the allocation should not be a candidate to provide a safety-of-life aspect as required by the GMDSS.

5/1.8/3.2.1 Allocations and other regulatory provisions to be taken into account

Various portions of the band 1 610.0-1 626.5 MHz are also allocated to the following services:

- aeronautical mobile-satellite (route) service (AMS(R)S),
- aeronautical radionavigation service (ARNS),
- fixed service (FS),
- radio astronomy service (RAS), and
- radiodetermination-satellite service (RDSS).

5/1.8/3.2.1.1 Allocations and associated matters

The services listed above and their current operational status are further discussed below.

- Pursuant to RR No. **5.367**, AMS(R)S is allocated on a primary basis in the band 1 610-1 626.5 MHz in both uplink and downlink directions, subject to agreement to be obtained under RR No. **9.21**.

Two views were expressed:

- View 1: It should be noted that, based on this allocation, the International Civil Aviation Organization (ICAO) has adopted Standards and Recommended Practices (SARPs) in relation to communications of different categories of AMS(R)S safety messages over the satellite system being considered by the IMO for provision of GMDSS.
 - View 2: There is no need to talk about SARPs and ICAO Standards, for inclusion in CPM text. Irrespective of actions taken under this agenda item, ICAO continues to apply the standards with respect to AMS(R)S. Moreover, it is not within the mandate nor the competence of ITU-R Study Groups to confirm or otherwise the compliance of operation of any system with ICAO standards.
- ARNS is allocated in the band 1 610-1 626.5 MHz. There are no known planned or operational ARNS systems in this band.
 - Radio astronomy service (RAS) operates in the 1 610.6-1 613.8 MHz frequency band on a primary basis. Resolution **359 (Rev.WRC-15)** invites WRC-19 to consider the

impact on the protection of the RAS, in accordance with RR No. **5.372**. In this connection some administrations operating RAS in the frequency band above have reported that, since 1998, harmful interference has been experienced from the downlink operations of this MSS system. This was reported to the ITU³ and to the responsible administration for the satellite system⁴. The responsible administration described measures⁵ it is taking that will, in its view, resolve the interference. (See also working document towards a PDN Report ITU-R M.[RAS.COMPAT].)

- Pursuant to RR No. **5.359**, FS is allocated in the band 1 610-1 626.5 MHz. It is noted that RR No. **5.359** (adopted before WARC-92) states: “*Administrations are urged to make all practicable efforts to avoid the implementation of new fixed-service stations in these frequency bands*”.
- The RDSS is allocated in the band 1 610-1 626.5 MHz on a primary basis in Region 2, and on a secondary basis in Regions 1 and 3 and under RR No. **5.364** is subject to coordination under RR No. **9.11A**. In addition, RR No. **5.369** provides for the RDSS (Earth-to-space) in the 1 610-1 626.5 MHz band on a primary basis for some countries in Regions 1 and 3 identified in the footnote, subject to agreement under RR No. **9.21** from countries not listed in this provision.

Two views were expressed:

- View 1: In the 1 613.8-1 626.5 MHz band, a downlink using a MSS secondary allocation (space-to-Earth) cannot claim protection from harmful interference from the uplink of satellite networks using the primary allocation (Earth-to-space), operating in accordance with the Radio Regulations.
- View 2: In the 1 613.8-1 626.5 MHz band, stations using the secondary MSS (space-to-Earth) allocation cannot claim protection from harmful interference from stations using the primary RDSS (Earth-to-space) allocation. However, in Regions 1 and 3, outside of the twenty administrations listed in RR No **5.369**, the RDSS (Earth-to-space) allocation is secondary in the remaining 138 Region 1 and Region 3 administrations. Consequently, both the RDSS (Earth-to-space) allocation and the MSS (space-to-Earth) allocation are of secondary allocation status. Regardless of the situation described above, before consideration of the secondary MSS (space-to-Earth) allocation vis-à-vis the primary RDSS (Earth-to-space) allocation, the operator of the primary RDSS (Earth-to-space) allocation must first effect successful coordination with the operator of the primary MSS (Earth-to-space) allocation. In the case of the MSS system that is under consideration by the IMO, and is at the basis of *resolves 2*, that MSS system would have date priority over any RDSS system filed subsequently. In this situation, successful coordination of MSS and RDSS uplinks on the basis of frequency overlap in the same geographical area may prove difficult. Furthermore, coordination with the primary MSS (Earth-to-space) allocation on the same satellite system would be also required by any primary RDSS (Earth-to-space) system notified subsequently. The above requirements in practice ensure protection of MSS secondary (space-to-Earth) assignments on the MSS system being considered by the IMO.

³ See ITU-R RRB 17.1 Document [2].

⁴ See Attachments 4, 6, 7, 8, 9, 10 and 11 of RRB 17.1 Document [2].

⁵ See ITU-R RRB 17.1 Document [5].

- The adjacent frequency band 1 626.5-1 660.5 MHz is allocated to the MSS (Earth-to-space).

Two views were expressed:

- View 1: Several MSS networks and systems use bands adjacent to, both above and below, those proposed for GMDSS operation for uplinks from mobile earth stations (MESs). It is important that non-GSO MESs planned to be used for GMDSS services be designed and installed in such a manner as to mitigate the effect of, and be resilient to, the potential interference from existing non-GSO and GSO terminals, including Global Mobile Personal Communications by Satellite (GMPCS), operating in those adjacent bands and remain within the purpose and objectives of the GMDSS. It is important for administrations to take this issue into account when deciding on the matter.
- View 2: MSS MESs to be used for GMDSS services within the frequency band 1 616-1 626.5 MHz should be designed and installed on ships in such a manner as to mitigate the effect of, and be resilient to, potential interference from other existing MSS terminals operating in the adjacent band. In this regard, the expert U.N. agency for maritime safety communications, the International Maritime Organization (IMO) provides performance standards for ship earth stations for use in the GMDSS⁶. Furthermore, it is important to note that management of communication devices that may operate on board ships is an on-going exercise carried out by the national licensing authorities.

5/1.8/3.2.1.2 Other regulatory provisions

- RR No. **1.59**, which defines a safety service.
- RR No. **5.368**, which references RR No. **4.10** and its applicability (if any) to the MSS and RDSS.
- RR No. **9.52C** including reference to RR No. **9.47** and RR No. **9.48** which describes the nature of coordination.
- RR Appendix **15** contains all frequencies and frequency bands used by the GMDSS.
- Paragraph 2.3 of RoP relating to RR No. **9.11A** which describes the need to coordinate.
- Paragraph 5 of RoP relating to RR No. **11.50** which explains the role of the BR resulting from the upgrade of an existing service.

5/1.8/4 Methods to satisfy the agenda item

Two methods are proposed to satisfy Issue A, while 5 methods are proposed to satisfy Issue B.

5/1.8/4.1 Issue A: Modernization of the global maritime distress and safety system (*resolves to invite ITU-R 1*)

5/1.8/4.1.1 Method A1

No change to the Radio Regulations.

⁶ See, IMO Resolution MSC.434(98), “*Performance Standards for a Ship Earth Station for use in the GMDSS*” (June 2017).

5/1.8/4.1.2 Method A2

MF NAVDAT

The frequency band 495-505 kHz is intended to be used for international MF NAVDAT.

The limitation on the use of the bands 415-495 kHz and 505-526.5 kHz (505-510 kHz in Region 2) in the maritime mobile service only by radiotelegraphy should be removed. And the possibility of using these bands by national MF NAVDAT could be given.

HF NAVDAT

It is needed to modify RR Appendix 17 to allow the frequency bands described in the most recent version of Recommendation ITU-R M.2058 to be used for the HF NAVDAT system. Therewith, proper regulatory provisions should be developed to ensure compatibility of HF NAVDAT systems with digital maritime mobile systems operating the frequency bands concerned subject to relevant existing allocations.

WRC-23 will consider the modernization of the GMDSS after IMO has concluded its work on this topic. Therefore, at that time it will be possible to consider a possible revision of RR Appendix 15.

5/1.8/4.2 Issue B: Introduction of additional satellite systems into global maritime distress and safety systems (*resolves to invite ITU-R 2*)

The methods described below were presented but were not discussed nor analysed. These methods, therefore, reflect the respective views of their proponents and do not reflect the consensus of ITU-R.

5/1.8/4.2.1 Method B1

Due to limited antenna discrimination provided by MSS earth stations, MSS frequency band segmentation is a well-established coordination approach amongst coordinating MSS satellite systems. In the case of MSS frequencies used in both uplink and downlink directions by the same user terminal of the satellite system, upon coordinating such frequency use in one direction, other satellite networks are in effect prevented access to those frequencies in the same geographical area. Non-presence of emissions from other satellite systems within the coordinated geographical area would ensure protection of using same frequencies in the other direction of transmission by the satellite system operating bidirectionally on the same frequencies.

The GMDSS-candidate non-GSO MSS system has been operating in a stable spectrum environment for twenty years and GMDSS carriage does not result in technical or operational changes to the system. No new allocations or associated studies are required. However, from a regulatory perspective, in order to implement the “recognition” by IMO of the system under consideration as a satellite provider for the GMDSS in the frequency band 1 616-1 626.5 MHz, regulatory modifications would be necessary to the Radio Regulations including:

- a) A footnote in the MSS allocations to identify their use in the GMDSS;
- b) Modification of provisions RR Nos. 5.364 and 5.368 in order to avoid any inconsistency and ambiguity about the regulatory status of the maritime mobile-satellite service in the band 1 616-1 626.5 MHz when used for GMDSS.
- c) The addition of the band 1 616-1 626.5 MHz to Table 15-2 of RR Appendix 15, as well as provisions RR No. 33.50 and RR No. 33.53 of RR Article 33.

Further, although Radio Regulations provisions regarding safety services are not linked to a particular allocation status, in introducing this frequency band in RR Appendix 15, to avoid that the secondary allocation for the downlink could be seen as a precedent and due to the unique nature of

the Iridium system where MSS frequencies are used in both the uplink and downlink directions within the same frequency band, a note could be associated with this band, which reads:

“In addition to its availability for routine non-safety purposes, the band 1 616-1 626.5 MHz is used for distress and safety purposes in the Earth-to-space and space-to-Earth directions in the maritime mobile-satellite service solely by satellite networks using the same channel in both directions.”

5/1.8/4.2.2 Method B2

This method addresses the regulatory status of the band 1 616-1 626.5 MHz with respect to MSS operations in the adjacent frequency band 1 626.5-1 660.5 MHz. The adjacent band is used by transmitting MESs in GSO MSS networks, including ship earth stations used in the GMDSS.

The current allocation to MSS (space-to-Earth) in the band 1 616-1 626.5 MHz is secondary, while the MSS (Earth-to-space) allocation in the band 1 626.5-1 660.5 MHz is primary.

Some methods (e.g. B1 and B5) would effectively change the regulatory status of the allocation to the MSS (space-to-Earth) in the band 1 616-1 626.5 MHz, effectively or directly raising that MSS allocation status to primary when used for GMDSS. This could lead to new constraints being placed on GSO MSS operations in the adjacent frequency band. Method B2 supplements these methods with additional regulatory text that would maintain the current regulatory status with respect to GSO MSS operations in the adjacent band.

The method would apply an additional regulatory provision in a footnote in Article 5 of the Radio Regulations, stating that mobile earth stations receiving in the band 1 616-1 626.5 MHz shall not claim protection from mobile earth stations transmitting in the adjacent band 1 626.5-1 660.5 MHz.

5/1.8/4.2.3 Method B3

As Method B1, but identifying only the MSS allocation in the 1 616-1 626.5 MHz (Earth-to-space) direction for GMDSS.

5/1.8/4.2.4 Method B4

With Method B4 a NOC is proposed due to the fact that a number of issues, including the regulatory status of the non-GSO system, and any potential adverse impact of any change to the regulatory status of in-band and adjacent systems or the apparent inconsistency and potential constraint of RR No. 5.368 have not been studied. Further, the compatibility issues related to the protection of the radio astronomy have not been solved.

5/1.8/4.2.5 Method B5

5/1.8/4.2.5.1 Method B5(a)

From a regulatory perspective, in order to implement the “recognition” by IMO of the system under consideration as a satellite provider for the GMDSS, regulatory modifications would be necessary to the Radio Regulations. One regulatory difficulty for the satellite network, which utilizes the band 1 613.8-1 626.5 MHz with TDD mode, is that it has a primary allocation for the uplink and solely a secondary allocation for the downlink.

A secondary allocation is not compatible with a safety service like the GMDSS; therefore it is proposed to upgrade the status from secondary to primary but solely for the frequency band 1 621.35-1 626.5 MHz. The reason is that in this frequency band the considered satellite network is the only one to operate and is not sharing with other satellite networks. This 5 MHz is fully sufficient to operate the GMDSS.

Nevertheless, the upgrade of the allocation shall not be interpreted as a relaxation of the obligation for Iridium to protect the radio astronomy. In this respect, it is noted that the secondary status of Iridium did not prevent interference to radio astronomy due to the fact that there are no regulatory limits protecting effectively the radio astronomy services. Therefore, it is proposed to define in the Radio Regulations the unwanted emission limits ensuring the protection of radio astronomy. A regulatory limit is considered as much more protective than the existing secondary status of MSS downlink in this frequency band.

This method will both satisfy the maritime community and improve the protection of radio astronomy.

The regulatory proposal for this method is as follows:

- Upgrade the status of the band 1 621.35-1 626.5 MHz from a secondary to a primary allocation to the MSS (space-to-Earth).
- Identify this band 1 621.35-1 626.5 MHz in RR Appendix 15 for GMDSS purpose with a note like “In addition to its availability for routine non-safety purposes, the band 1 621.35-1 626.5 MHz is used for distress and safety purposes in the Earth-to-space and space-to-Earth directions in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band.”
- Modification of RR Nos. 5.364 and 5.368 in order to remove any ambiguity due to the upgrade of the status for the downlink segment.
- The band 1 613.8-1 621.35 MHz will remain secondary for MSS (space-to-Earth).
- A modification of RR No. 5.372 is proposed introducing the maximum value of *epfd* and *pfd* defined in Resolution 739 (Rev.WRC-15), in order to make mandatory and quantify the protection of the radio astronomy.
- Adjustment of RR No. 5.208B and of Resolution 739 (Rev.WRC-15) in order not to refer any more to the band 1 613.8-1 626.5 MHz. The Resolution gives just a threshold of “best effort” which is less effective than a regulatory limit. In any case the RR No. 5.208B could be suppressed for the band 1 613.8-1 626.5 MHz due to the modification of RR No. 5.372.
- Consequential modifications in RR Article 33 are proposed.
- Suppression of Resolution 359 (Rev.WRC-15) with regard to *resolves* 2.

5/1.8/4.2.5.2 Method B5(b)

As Method B5(a), but limiting modification of the allocation to the maritime mobile-satellite service as follows:

- upgrade the status of the band 1 621.35-1 626.5 MHz from a secondary to a primary allocation to the MMSS (space-to-Earth);
- the band 1 613.8-1 626.35 MHz will remain secondary for MSS (space-to-Earth).

MOD

495-1 800 kHz

Allocation to services		
Region 1	Region 2	Region 3
495-505	MARITIME MOBILE	ADD 5.A18

ADD

5.A18 The band 495-505 kHz is exclusively used for the international NAVDAT system as described in the most recent version of Recommendation ITU-R M.2010. (WRC-19)

HF NAVDAT

The possible modifications to the provisions of RR are considered as follows:

MOD

APPENDIX 17 (REV.WRC-~~15~~19)

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service

(See Article 52)

...

ANNEX 1* (REV.WRC-1519)

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service, in force until 31 December 2016 (WRC-12)

MOD

PART A – Table of subdivided bands (WRC-0719)

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (continued)

Band (MHz)	4	6	8	12	16	18/19	22	25/26
...
Limits (kHz)	4 221	6 332.5	8 438	12 658.5	16 904.5	19 705	22 445.5	26 122.5
Frequencies assignable to coast stations for wide-band and A1A or A1B Morse telegraphy, wideband systems, facsimile, special and data transmission systems and direct-printing telegraphy systems <i>m) p) pp) s)</i>								
Limits (kHz)	4 351	6 501	8 707	13 077	17 242	19 755	22 696	26 145

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p) These sub-bands, except the frequencies referred to in Notes j), n) and o), may be used for the initial testing and the possible future introduction within the maritime mobile service of new digital technologies. Stations using these sub-bands for this purpose shall not cause harmful interference to, and shall not claim protection from, other stations operating in accordance with Article 5.

pp) These sub-bands are also designated for the NAVDAT system as described in the most recent version of Recommendation ITU-R M.2058.

SUP

RESOLUTION 359 (REV.WRC-15)

Consideration of regulatory provisions for updating and modernization of the Global Maritime Distress and Safety System

* Note by the Secretariat: Annex 1 contains the entire text of Appendix 17 (REV.WRC-07)

5/1.8/5.2 For Issue B

5/1.8/5.2.1 For Method B1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD

5.364 The use of the band 1 610-1 626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to coordination under No. **9.11A**. A mobile earth station operating in either of the services in this band shall not produce a peak e.i.r.p. density in excess of -15 dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. **5.366** (to which No. **4.10** applies), unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, the mean e.i.r.p. density of a mobile earth station shall not exceed -3 dB(W/4 kHz).

Except when used for distress and safety purposes in the band 1 616-1 626.5 MHz by satellite networks in the maritime mobile-satellite service using the same channel in the Earth-to-space and space-to-Earth directions, stations of the mobile-satellite service, operating in any direction of transmission, shall not claim protection from stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. **5.366** and stations in the fixed service operating in accordance with the provisions of No. **5.359**. Administrations responsible for the coordination of mobile-satellite networks shall make all practicable efforts to ensure protection of stations operating in accordance with the provisions of No. **5.366**. (WRC-19)

Reasons: To recognize the safety service aspects of GMDSS operations within the band 1 616-1 626.5 MHz.

MOD

5.368 With respect to the radiodetermination-satellite and mobile-satellite services the provisions of No. **4.10** do not apply in the band 1 610-~~1 626.5~~ **1 616** MHz, with the exception of the aeronautical radionavigation-satellite service. (WRC-19)

Reasons: To recognize that the band 1 616-1 626.5 MHz is used for safety services. Consequently, RR No. **4.10** applies.

The following addition of RR No. **5.GMDSS-B1** to RR Article **5** could be either a standalone footnote or combined with another footnote:

ADD

5.GMDSS-B1 The band 1 616-1 626.5 MHz may also be used in the Earth-to-space and space-to-Earth directions for the provision of distress, urgency, and safety communications of the Global Maritime Distress and Safety System (GMDSS). See Appendix **15**, Table 15-2, No. **33.50** and No. **33.53**. (WRC-19)

Reasons: To identify the band 1 616-1 626.5 MHz as being available for the provision of GMDSS by mobile-satellite service systems.

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APPENDIX 15 (REV.WRC-~~15~~19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS)

(See Article 31)

The frequencies for distress and safety communications for the GMDSS are given in Tables 15-1 and 15-2 for frequencies below and above 30 MHz, respectively.

NOC

TABLE 15-1 (WRC-07)
Frequencies below 30 MHz

MOD

TABLE 15-2 (WRC-~~15~~19)
Frequencies above 30 MHz (VHF/UHF)

Frequency (MHz)	Description of usage	Notes
...
*1 544-1 545	D&S-OPS	Use of the band 1 544-1 545 MHz (space-to-Earth) is limited to distress and safety operations (see No. 5.356), including feeder links of satellites needed to relay the emissions of satellite emergency position-indicating radio beacons to earth stations and narrow-band (space-to-Earth) links from space stations to mobile stations.
<u>1 616-1 626.5</u>	<u>SAT-COM</u>	<u>In addition to its availability for routine non-safety purposes, the band 1 616-1 626.5 MHz is used for distress and safety purposes in the Earth-to-space and space-to-Earth directions in the maritime mobile-satellite service solely by satellite networks using the same channel in both directions. GMDSS distress, urgency and safety communications have priority in this band over non-safety communications within the same satellite system. (WRC-19)</u>
1 626.5-1 645.5	SAT-COM	In addition to its availability for routine non-safety purposes, the band 1 626.5-1 645.5 MHz is used for distress and safety purposes in the Earth-to-space direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band (see No. 5.353A).
...

Legend:

...

Reasons: To add the band 1 616-1 626.5 MHz as being available for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS).

ARTICLE 33

Operational procedures for urgency and safety communications in the global maritime distress and safety system (GMDSS)

Section V – Transmission of maritime safety information²

33.49

E – Maritime safety information via satellite

MOD

33.50 § 26 Maritime safety information may be transmitted via satellite in the maritime mobile-satellite service using the bands 1 530-1 545 MHz and 1 616-1 626.5 MHz (see Appendix 15). (WRC-19)

Reasons: To include the 1 616-1 626.5 MHz band as being available for transmitting maritime safety information via satellite.

Section VII – Use of other frequencies for safety (WRC-07)

MOD

33.53 § 28 Radiocommunications for safety purposes concerning ship reporting communications, communications relating to the navigation, movements and needs of ships and weather observation messages may be conducted on any appropriate communications frequency, including those used for public correspondence. In terrestrial systems, the bands 415-535 kHz (see Article 52), 1 606.5-4 000 kHz (see Article 52), 4 000-27 500 kHz (see Appendix 17), and 156-174 MHz (see Appendix 18) are used for this function. In the maritime mobile-satellite service, frequencies in the bands 1 530-1 544 MHz, 1 616-1 626.5 MHz and 1 626.5-1 645.5 MHz are used for this function as well as for distress alerting purposes (see No. 32.2). (WRC-07/19)

Reasons: To apply RR No. 33.53 to the 1 610-1 626.5 MHz band for use by mobile-satellite service systems approved by the International Maritime Organization to participate in the Global Maritime Safety and Distress System.

5/1.8/5.2.2 For Method B2

As Methods B1 or B5, but with the following addition to RR Article 5, either as a standalone footnote or combined with another footnote:

ADD

5.GMDSS-B2 Mobile earth stations receiving in the band 1 616-1 626.5 MHz shall not claim protection from mobile earth stations transmitting in the band 1 626.5-1 660.5 MHz. (WRC-19)

Reasons: To maintain the current regulatory status with respect to MSS operations in the band 1 626.5-1 660.5 MHz.

5/1.8/5.2.3 For Method B3

As Method B1, except:

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MOD

5.364 The use of the band 1 610-1 626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to coordination under No. **9.11A**. A mobile earth station operating in either of the services in this band shall not produce a peak e.i.r.p. density in excess of -15 dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. **5.366** (to which No. **4.10** applies), unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, the mean e.i.r.p. density of a mobile earth station shall not exceed -3 dB(W/4 kHz).

Except when used for distress and safety purposes in the band 1 616-1 626.5 MHz by satellite networks in the maritime mobile-satellite service in the Earth-to-space direction, Stations of the mobile-satellite service shall not claim protection from stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. **5.366** and stations in the fixed service operating in accordance with the provisions of No. **5.359**. Administrations responsible for the coordination of mobile-satellite networks shall make all practicable efforts to ensure protection of stations operating in accordance with the provisions of No. **5.366**. (WRC-19)

MOD

5.368 With respect to the radiodetermination-satellite and mobile-satellite services the provisions of No. **4.10** do not apply in the band 1 610-1 626.5 MHz, with the exception of the aeronautical radionavigation-satellite service and of the maritime mobile-satellite service in the band 1 616-1 626.5 MHz (Earth-to-space) solely when used for GMDSS by satellite networks in the Earth-to-space direction for distress and safety purposes. (WRC-19)

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Reasons: To recognize that in the band 1 616-1 626.5 MHz (Earth-to-space) the maritime mobile-satellite service is used for the provision of maritime safety services. Consequently, RR No. **4.10** should apply.

The following addition of RR No. **5.GMDSS-B3** to RR Article **5** could be either a standalone footnote or combined with another footnote:

ADD

5.GMDSS-B3 The band 1 616-1 626.5 MHz may also be used in the Earth-to-space direction for the provision of distress, urgency, and safety communications of the Global Maritime Distress and Safety System (GMDSS). See Appendix **15**, Table 15-2, No. **33.50** and No. **33.53**. (WRC-19)

Reasons: To identify the band 1 616-1 626.5 MHz (Earth-to-space) as being available for the provision of GMDSS by mobile-satellite service systems.

MOD

APPENDIX 15 (REV. WRC-~~15~~19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS)

(See Article **31**)

The frequencies for distress and safety communications for the GMDSS are given in Tables 15-1 and 15-2 for frequencies below and above 30 MHz, respectively.

NOC

TABLE 15-1 (WRC-07)
Frequencies below 30 MHz

MOD

TABLE 15-2 (WRC-15/19)
Frequencies above 30 MHz (VHF/UHF)

Frequency (MHz)	Description of usage	Notes
...
*1 544-1 545	D&S-OPS	Use of the band 1 544-1 545 MHz (space-to-Earth) is limited to distress and safety operations (see No. 5.356), including feeder links of satellites needed to relay the emissions of satellite emergency position-indicating radio beacons to earth stations and narrow-band (space-to-Earth) links from space stations to mobile stations.
1 616-1 626.5	SAT-COM	In addition to its availability for routine non-safety purposes, the band 1 616-1 626.5 MHz (Earth-to-space) is used for distress and safety purposes in the Earth-to-space direction in the maritime mobile-satellite service solely by satellite networks using the same channel in both directions. GMDSS distress, urgency and safety communications have priority in this band over non-safety communications within a satellite system. (WRC-19)
1 626.5-1 645.5	SAT-COM	In addition to its availability for routine non-safety purposes, the band 1 626.5-1 645.5 MHz is used for distress and safety purposes in the Earth-to-space direction in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band (see No. 5.353A).
...

Reasons: To add the band 1 616-1 626.5 MHz as being available for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS).

ARTICLE 33

Operational procedures for urgency and safety communications in the global maritime distress and safety system (GMDSS)

Section VII – Use of other frequencies for safety (WRC-07)

MOD

33.53 § 28 Radiocommunications for safety purposes concerning ship reporting communications, communications relating to the navigation, movements and needs of ships and weather observation messages may be conducted on any appropriate communications frequency, including those used for public correspondence. In terrestrial systems, the bands 415-535 kHz

(see Article 52), 1 606.5-4 000 kHz (see Article 52), 4 000-27 500 kHz (see Appendix 17), and 156-174 MHz (see Appendix 18) are used for this function. In the maritime mobile-satellite service, frequencies in the bands 1 530-1 544 MHz, 1 616-1 626.5 MHz (Earth-to-space) and 1 626.5-1 645.5 MHz are used for this function as well as for distress alerting purposes (see No. 32.2). (WRC-07¹⁹)

Reasons: To apply RR No. 33.53 to the 1 610-1 626.5 MHz band for use by mobile-satellite service systems approved by the International Maritime Organization to participate in the Global Maritime Safety and Distress System.

5/1.8/5.2.4 For Method B4

NOC

ARTICLES

NOC

APPENDICES

NOC

RESOLUTIONS

NOC

RECOMMENDATIONS

Reasons: In order to introduce an additional satellite system into the GMDSS, the frequency band to be used by this system must be entered into RR Appendix 15. Regarding the frequency band 1 613.8-1 626.5 MHz, the secondary MSS allocation in the space-to-Earth direction cannot be considered for GMDSS.

A satellite system, the downlink of which:

- 1) has a status of “non-interference, non-protection” vis-à-vis any primary service within the same band and in adjacent bands; and
- 2) has currently no reliable coordination criteria, apart from frequency overlap which is one among other interference criteria to accomplish coordination, should not be a candidate to provide safety-of-life aspects as required by the GMDSS.

Moreover according to paragraph 2.3 of the Rules of Procedure relating to application of RR No. 9.11A (“While recognizing the difficulties of harmonizing the text of the footnotes to Article 5 introduced by WARC-92, WRC-95 and WRC-97 on the one hand and the text of the provision of No. 9.11A (including Nos. 9.12 to 9.16) and 9.17A, as appropriate with respect to the services to which this provision is applicable, on the other hand, the Board concluded that the procedure is applicable to all other space and terrestrial services with respect to those satellite services having allocations with equal rights and mentioned in the specific footnotes to which this provision applies. The frequency bands are those to which, in a footnote, reference is made to this provision in the Table of Frequency Allocations (see Tables 9.11A-1 and 9.11A-2 below). In these Tables, there is an indication of those other space services (in addition to the MSS and radiodetermination-satellite

service as well as non-GSO MSS feeder links and non-GSO FSS included in the footnotes) to which this coordination procedure shall also apply”).

The downlink of the HIBLEO-2 using the band 1 613.8-1 626.5 MHz was not required to coordinate with any space or terrestrial service of primary status. Consequently, should a primary status (on a provisional basis) be granted to this allocation, it is fundamental for the downlink assignments of HIBLEO-2 to carry out the required coordination with all space and terrestrial services submitted to the Bureau until a decision can be made to identify it for GDMSS. Finally the consequences of such action must be analysed.

In addition to the lack of reliable criteria for application of RR No. **9.11A**, pursuant to RR No. **9.52C** (“For coordination requests under Nos. **9.11** to **9.14** and **9.21**, an administration not responding under No. **9.52** within the same four-month period shall be regarded as unaffected and, in the cases of Nos. **9.11** to **9.14**, the provisions of Nos. **9.48** and **9.49** shall apply.”) unlike RR No. **9.7** the coordination procedure is of an implicit type, i.e., those administrations which failed to reply to request for coordination were considered as not affected even though in reality they were affected.

On account of any attempt to upgrade the status of this allocation from secondary to primary to fulfil this agenda item, the following studies are needed to be carried out:

- a) the amount of bandwidth required for GMDSS while the allocated MSS band is also used for routine non-safety purposes;
- b) the sharing and compatibility of the MSS system in the considered frequency band with incumbent services in the same and in adjacent bands;
- c) the potential impact of possible modifications to the provisions of the Radio Regulations on sharing and compatibility with other services and systems in the frequency band and adjacent frequency bands.

The issues listed above have not been studied or resolved. The inconsistency and potential constraint of RR Nos. **5.364** and **5.368** have not been studied. The harmful interference from the MSS space-to-Earth operations continues to exist in the radio astronomy frequency band 1 610.6-1 613.8 MHz and several administrations are having ongoing communications with the ITU-R RRB on this interference issue. The frequency band 1 613.8-1 626.5 MHz, or any part thereof, is therefore to be considered not suitable for use in GMDSS as long as these studies have not been carried out.

5/1.8/5.2.5 For Method B5

5/1.8/5.2.5.1 For Method B5(a)

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

1 610-1 660 MHz

Allocation to services		
Region 1	Region 2	Region 3
<p>1 613.8-1 626.51 621.35</p> <p>MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B</p> <p>5.341 5.355 5.359 <u>MOD</u> 5.364 5.365 5.366 5.367 <u>MOD</u> 5.368 5.369 5.371 <u>MOD</u> 5.372</p>	<p>1 613.8-1 626.51 621.35</p> <p>MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) Mobile-satellite (space-to-Earth) 5.208B</p> <p>5.341 <u>MOD</u> 5.364 5.365 5.366 5.367 <u>MOD</u> 5.368 5.370 <u>MOD</u> 5.372</p>	<p>1 613.8-1 626.51 621.35</p> <p>MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B</p> <p>Radiodetermination-satellite (Earth-to-space)</p> <p>5.341 5.355 5.359 <u>MOD</u> 5.364 5.365 5.366 5.367 <u>MOD</u> 5.368 5.369 <u>MOD</u> 5.372</p>
<p>1-613.81 621.35-1 626.5</p> <p>MOBILE-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B</p> <p>5.341 5.355 5.359 <u>MOD</u> 5.364 5.365 5.366 5.367 <u>MOD</u> 5.368 5.369 5.371 <u>MOD</u> 5.372</p>	<p>1-613.81 621.35-1 626.5</p> <p>MOBILE-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) Mobile-satellite (space-to-Earth) 5.208B</p> <p>5.341 <u>MOD</u> 5.364 5.365 5.366 5.367 <u>MOD</u> 5.368 5.370 <u>MOD</u> 5.372</p>	<p>1-613.81 621.35-1 626.5</p> <p>MOBILE-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B</p> <p>Radiodetermination-satellite (Earth-to-space)</p> <p>5.341 5.355 5.359 <u>MOD</u> 5.364 5.365 5.366 5.367 <u>MOD</u> 5.368 5.369 <u>MOD</u> 5.372</p>
<p>1 626.5-1 660</p>	<p>MOBILE-SATELLITE (Earth-to-space) 5.351A 5.341 5.351 5.353A 5.354 5.355 5.357A 5.359 5.362A 5.374 5.375 5.376</p>	

MOD

5.208B* In the frequency bands:

- 137-138 MHz,
- 387-390 MHz,
- 400.15-401 MHz,
- 1 452-1 492 MHz,
- 1 525-1 610 MHz
- ~~1 613.8-1 626.5 MHz,~~
- 2 655-2 690 MHz,
- 21.4-22 GHz,

Resolution **739 (Rev.WRC-15)** applies. (WRC-~~15~~19)

MOD

5.364 The use of the band 1 610-1 626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to coordination under No. **9.11A**. A mobile earth station operating in either of the services in this band shall not produce a peak e.i.r.p. density in excess of -15 dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. **5.366** (to which No. **4.10** applies), unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, the mean e.i.r.p. density of a mobile earth station shall not exceed -3 dB(W/4 kHz).

Except when used for distress and safety purposes in the band 1 621.35-1 626.5 MHz (see Appendix 15), stations of the mobile-satellite service shall not claim protection from stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. **5.366** and stations in the fixed service operating in accordance with the provisions of No. **5.359**. Administrations responsible for the coordination of mobile-satellite networks shall make all practicable efforts to ensure protection of stations operating in accordance with the provisions of No. **5.366**. (WRC-19)

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MOD

5.368 With respect to the radiodetermination-satellite and mobile-satellite services the provisions of No. **4.10** do not apply in the band 1 610-1 626.5 MHz, with the exception of the aeronautical radionavigation-satellite service and of the mobile-satellite service in the band 1 621.35-1 626.5 MHz when used for GMDSS. (WRC-19)

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MOD

5.372 Harmful interference shall not be caused to stations of the radio astronomy service using the band 1 610.6-1 613.8 MHz by stations of the radiodetermination-satellite and mobile-satellite services (No. **29.13** applies). Non-GSO satellite systems operating in the band 1 613.8-1 626.5 MHz shall not exceed an epfd of -258 dBW/m²/20 kHz in the band 1 610.6-1 613.8 MHz unless the data loss resulting from exceeding this limit is less than 2%, and GSO satellite networks operating in the band 1 613.8-1 626.5 MHz shall not exceed a pfd of -194 dBW/m²/20 kHz in the band 1 610.6-1 613.8 MHz, at any radio astronomy station performing observations in this band. The verification of the compliance with the epfd threshold for non-GSO systems shall be done using

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Recommendation ITU-R M.1583-1 and the antenna pattern and the maximum antenna gain given in Recommendation ITU-R RA.1631-0. (WRC-19)

ARTICLE 33

Operational procedures for urgency and safety communications in the global maritime distress and safety system (GMDSS)

Section V – Transmission of maritime safety information²

33.49 *E – Maritime safety information via satellite*

MOD

33.50 § 26 Maritime safety information may be transmitted via satellite in the maritime mobile-satellite service using the bands 1 530-1 545 MHz and 1 621.35-1 626.5 MHz (see Appendix 15). (WRC-19)

MOD

Section VII – Use of other frequencies for safety (Rev.WRC-0719)

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MOD

33.53 § 28 Radiocommunications for safety purposes concerning ship reporting communications, communications relating to the navigation, movements and needs of ships and weather observation messages may be conducted on any appropriate communications frequency, including those used for public correspondence. In terrestrial systems, the bands 415-535 kHz (see Article 52), 1 606.5-4 000 kHz (see Article 52), 4 000-27 500 kHz (see Appendix 17), and 156-174 MHz (see Appendix 18) are used for this function. In the maritime mobile-satellite service, frequencies in the bands 1 530-1 544 MHz, 1 621.35-1 626.5 MHz and 1 626.5-1 645.5 MHz are used for this function as well as for distress alerting purposes (see No. 32.2). (WRC-0719)

MOD

APPENDIX 15 (REV.WRC-~~15~~19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS)

(See Article 31)

The frequencies for distress and safety communications for the GMDSS are given in Tables 15-1 and 15-2 for frequencies below and above 30 MHz, respectively.

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MOD

TABLE 15-2 (end) (WRC-~~15~~19)

Frequency (MHz)	Description of usage	Notes
...
1 621.35-1 626.5	SAT-COM	<u>In addition to its availability for routine non-safety purposes, the band 1 621.35-1 626.5 MHz is used for distress and safety purposes in the Earth-to-space and space-to-Earth directions in the mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band.</u>
...

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RESOLUTION 739 (REV.WRC-~~15~~19)

Compatibility between the radio astronomy service and the active space services in certain adjacent and nearby frequency bands

The World Radiocommunication Conference (~~Geneva, 2015~~Sharm el-Sheikh, 2019),

...

ANNEX 1 TO RESOLUTION 739 (REV.WRC-~~15~~19)

...

TABLE 1-1
**pdf thresholds for unwanted emissions from any geostationary space station
at a radio astronomy station**

Space service	Space service frequency band	Radio astronomy frequency band	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by the Bureau following the entry into force of the Final Acts of:
			pdf ⁽¹⁾	Reference bandwidth	pdf ⁽¹⁾	Reference bandwidth	pdf ⁽¹⁾	Reference bandwidth	
	(MHz)	(MHz)	(dB(W/m ²))	(MHz)	(dB(W/m ²))	(kHz)	(dB(W/m ²))	(kHz)	
MSS (space-to-Earth)	387-390	322-328.6	-189	6.6	-204	10	-177	10	WRC-07
BSS MSS (space-to-Earth)	1 452-1 492 1 525-1 559	1 400-1 427	-180	27	-196	20	-166	20	WRC-03
MSS (space-to-Earth) MSS (space-to-Earth)	1 525-1 559 1 613.8-1 626.5	1 610.6-1 613.8	NA	NA	-194	20	-166	20	WRC-03
RNSS (space-to-Earth)	1 559-1 610	1 610.6-1 613.8	NA	NA	-194	20	-166	20	WRC-07
BSS FSS (space-to-Earth)	2 655-2 670	2 690-2 700	-177	10	NA	NA	-161	20	WRC-03
FSS (space-to-Earth)	2 670-2 690	2 690-2 700 (in Regions 1 and 3)	-177	10	NA	NA	-161	20	WRC-03
	(GHz)	(GHz)	-	-	-	-	-	-	
BSS	21.4-22.0	22.21-22.5	-146	290	-162	250	-128	250	WRC-03 for VLBI, and WRC-07 for other types of observation

NA: Not applicable, measurements of this type are not made in this frequency band.

⁽¹⁾ Integrated over the reference bandwidth with an integration time of 2 000 s.

TABLE 1-2
**epfd thresholds⁽¹⁾ for unwanted emissions from all space stations of a non-GSO satellite system
at a radio astronomy station**

Space service	Space service frequency band (MHz)	Radio astronomy frequency band (MHz)	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by the Bureau following the entry into force of the Final Acts of:
			epfd ⁽²⁾	Reference bandwidth	epfd ⁽²⁾	Reference bandwidth	epfd ⁽²⁾	Reference bandwidth	
			(dB(W/m ²))	(MHz)	(dB(W/m ²))	(kHz)	(dB(W/m ²))	(kHz)	
MSS (space-to-Earth)	137-138	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-07
MSS (space-to-Earth)	387-390	322-328.6	-240	6.6	-255	10	-228	10	WRC-07
MSS (space-to-Earth)	400.15-401	406.1-410	-242	3.9	NA	NA	NA	NA	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 400-1 427	-243	27	-259	20	-229	20	WRC-07
RNSS (space-to-Earth) ⁽³⁾	1 559-1 610	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 613.8-1 626.5	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07

NA: Not applicable, measurements of this type are not made in this frequency band.

⁽¹⁾ These epfd thresholds should not be exceeded for more than 2% of time.

⁽²⁾ Integrated over the reference bandwidth with an integration time of 2 000 s.

⁽³⁾ This Resolution does not apply to current and future assignments of the radionavigation-satellite system GLONASS/GLONASS-M in the frequency band 1 559-1 610 MHz, irrespective of the date of reception of the related coordination or notification information, as appropriate. The protection of the radio astronomy service in the frequency band 1 610.6-1 613.8 MHz is ensured and will continue to be in accordance with the bilateral agreement between the Russian Federation, the notifying administration of the GLONASS/GLONASS-M system, and IUCAF, and subsequent bilateral agreements with other administrations.

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SUP

RESOLUTION 359 (REV.WRC-15)

**Consideration of regulatory provisions for updating and modernization of the
Global Maritime Distress and Safety System**

5/1.8/5.2.5.2 For Method B5(b)

As Method B5(a) except as follows:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

1 610-1 660 MHz

Allocation to services		
Region 1	Region 2	Region 3
1 613.8-1 626.51 621.35 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B	1 613.8-1 626.51 621.35 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION RADIODETERMINATION- SATELLITE (Earth-to-space) Mobile-satellite (space-to-Earth) 5.208B	1 613.8-1 626.51 621.35 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B Radiodetermination-satellite (Earth-to-space)
5.341 5.355 5.359 MOD 5.364 5.365 5.366 5.367 MOD 5.368 5.369 5.371 MOD 5.372	5.341 MOD 5.364 5.365 5.366 5.367 MOD 5.368 5.370 MOD 5.372	5.341 5.355 5.359 MOD 5.364 5.365 5.366 5.367 MOD 5.368 5.369 MOD 5.372

<p>1-613.81 621.35-1 626.5 MARITIME MOBILE-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) <u>except maritime mobile-satellite (space-to-Earth)</u> 5.208B</p> <p>5.341 5.355 5.359 MOD 5.364 5.365 5.366 5.367 MOD 5.368 5.369 5.371 MOD 5.372</p>	<p>1-613.81 621.35-1 626.5 MARITIME MOBILE-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) Mobile-satellite (space-to-Earth) <u>except maritime mobile-satellite (space-to-Earth)</u> 5.208B</p> <p>5.341 MOD 5.364 5.365 5.366 5.367 MOD 5.368 5.370 MOD 5.372</p>	<p>1-613.81 621.35-1 626.5 MARITIME MOBILE-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) <u>except maritime mobile-satellite (space-to-Earth)</u> 5.208B Radiodetermination-satellite (Earth-to-space)</p> <p>5.341 5.355 5.359 MOD 5.364 5.365 5.366 5.367 MOD 5.368 5.369 MOD 5.372</p>
<p>1 626.5-1 660 MOBILE-SATELLITE (Earth-to-space) 5.351A 5.341 5.351 5.353A 5.354 5.355 5.357A 5.359 5.362A 5.374 5.375 5.376</p>		

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5.368 With respect to the radiodetermination-satellite and mobile-satellite services the provisions of No. **4.10** do not apply in the band 1 610-1 626.5 MHz, with the exception of the aeronautical radionavigation-satellite service and of the maritime mobile-satellite service in the band 1 621.35-1 626.5 MHz when used for GMDSS. (WRC-19)

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APPENDIX 15 (REV.WRC-~~15~~19)

Frequencies for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS)

(See Article 31)

The frequencies for distress and safety communications for the GMDSS are given in Tables 15-1 and 15-2 for frequencies below and above 30 MHz, respectively.

MOD

TABLE 15-2 (end) (WRC-1519)

Frequency (MHz)	Description of usage	Notes
...
1 621.35-1 626.5	SAT-COM	<u>In addition to its availability for routine non-safety purposes, the band 1 621.35-1 626.5 MHz is used for distress and safety purposes in the Earth-to-space and space-to-Earth directions in the maritime mobile-satellite service. GMDSS distress, urgency and safety communications have priority in this band.</u>
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Agenda item 1.9.1

(WP 5B / WP 4C, WP 5A, WP 5C, (WP 1B), (WP 3M), (WP 7D))

1.9 to consider, based on the results of ITU-R studies:

1.9.1 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);

Resolution 362 (WRC-15) – Autonomous maritime radio devices operating in the frequency band 156-162.05 MHz

5/1.9.1/1 Executive summary

The aim of this agenda item is to prevent unregulated operation of autonomous maritime radio devices (AMRD) in order to enhance safety of navigation and to ensure the integrity of the global maritime distress and safety system (GMDSS) which is the only system for distress, urgency, safety and routine communication for general shipping. Furthermore, the integrity of the collision avoidance system, automatic identification system (AIS), including the AIS VHF data link needs to be ensured.

Four methods to satisfy this agenda item were developed. It is noted that according to Resolution ITU-R 2-7 Annex 2 Section 4 “methods of no change is always a possible method and normally should not be included amongst the methods”.

One method considers amendments to the footnote *f*) in RR Appendix 18 to allow AMRD Group A to operate on certain channels.

Three methods consider the harmonization of the spectrum use for AMRD Group B. One method aims to use channel 2006 as listed in RR Appendix 18 for AIS technology. The second method aims to use channels 2078, 2019 and 2079 as listed in RR Appendix 18 for non-AIS technology. The third method aims to use the frequency band 161.4375-161.4875 MHz, which is not part of RR Appendix 18, for non-AIS technology.

5/1.9.1/2 Background

Studies on this WRC-19 agenda item are based on the following definition of AMRD:

An AMRD is a *mobile station*; operating at sea and transmitting independently of a *ship station* or a *coast station*. Two groups of AMRD are identified:

- Group A: AMRD that enhance the safety of navigation;
- Group B: AMRD that do not enhance the safety of navigation (AMRD which deliver signals or information which do not concern the vessel can distract or mislead the navigator and degrade the safety of navigation).

Considering a) of Resolution 362 (WRC-15) introduces the need to “enhance safety of navigation”. The relevant term is derived from the International Convention for the Safety of Life at Sea (SOLAS), as amended. Within SOLAS, Chapter V is titled “Safety of navigation” and contains all relevant regulations. Consequently, the criterion for distinguishing the two categories of AMRD is the influence on the safety of navigation. Any signal or information originated by an AMRD, which reaches the navigator, may influence the safety of navigation. This includes AIS (symbols to be shown on radar and on the electronic chart display and information system (ECDIS), if equipped) and VHF (working channels, Ch. 16 and Ch. 70). In any case, the navigator has to decide how to

proceed. In a positive case, the safety of navigation will be enhanced. But in other cases, AMRD which deliver signals or information which do not concern the vessel can distract or mislead the navigator and degrade the safety of navigation.

Although the term “safety of navigation” is used in SOLAS and other International Maritime Organization (IMO) documents, there is no formal existing definition. The regulations listed in SOLAS Chapter V are relevant to achieve safety of navigation. WDPDN Report ITU-R M.[AMRD] explains how “safety of navigation” has to be understood to evaluate the categories of AMRD.

Consequently, in distinguishing the two groups of AMRD, the following question has to be answered: is safety of navigation enhanced or rather degraded?

AMRD that enhance the safety of navigation may be subject to IMO SOLAS regulations for the presentation of information to the navigators on board vessels. AMRD categorized as “Group A” are contained in Recommendation ITU-R M.[AMRD] in a dedicated list of applications, in consultation with IMO. The other not listed AMRD have to be considered as Group B AMRD.

Sharing and compatibility studies between AMRD in the mobile service and other existing services, including land mobile service, would be required to ensure compatibility with incumbent services if AMRD were to use frequencies not listed in RR Appendix 18.

5/1.9.1/3 Summary and analysis of the results of ITU-R studies

5/1.9.1/3.1 Applications with autonomous maritime radio devices

To distinguish the two categories of AMRD, a two-step approach was used.

The first step was a compilation of the existing applications of AMRD which could be found on the market worldwide. To get a clear overview on these devices, to compile and to categorize the existing AMRD in the different countries, Circular Letter 5/LCCE/64 was sent to ITU Member States with a questionnaire to request information of such devices. Responses were received from 16 member administrations and one non-governmental organization member.

The responses are summarized in the WDPDN Report ITU-R M.[AMRD].

The information was consolidated to give a general description of the applications. Applications described in the responses to the questionnaire included diver emergency and Danbuoy/lifebuoy uses and these have been included in a man overboard (MOB) category as the function appears the same: A separate category for routine diver functions has been created.

The result shows that some devices are using AIS channels in the maritime mobile service frequency bands. Different transmitting power and intervals, message formats and unregulated maritime mobile service identities (MMSIs) are used by these AMRD.

Fishnet indicators have been divided into two categories; one to identify and locate a hazard; one for net recovery only.

General categories of “Tracking an object which is not a hazard to navigation” and possible future “Mobile aid to navigation (mobile AtoN) for an object which is a hazard to navigation” have been created. A racing mark and an oceanographic meteorological buoy could be in either category.

Emergency position-indicating radiobeacon (EPIRB) and AIS-search and rescue transmitter (SART) are components in the GMDSS and therefore not considered to be AMRD.

Two respondents indicated that future mobile AtoN might include virtual and physical types.

One respondent also reported devices operating on industrial, scientific and medical (ISM) frequencies.

The second step was listing the technical details of the various AMRD and its applications. Various technologies, such as AIS, digital selective calling, synthetic voice, or the combination of the technologies have been observed. In addition to channels 6/16/70, AIS 1, AIS 2 and other frequency bands outside the maritime mobile service, some AMRD are wrongly using 121.5 MHz and/or 406 MHz. Other AMRD use identities in the maritime mobile service such as MMSI.

The operation of AMRD is also various. Some AMRD are deployed at sea, others are carried by divers and used in the vessel and the vicinity. So, AMRD could be used at sea including the coastal areas, and AMRD may be brought into land or may be washed ashore by accident.

It could be concluded from the studies that the application of AMRD lacks harmonized technical standards and frequency bands. The operation of AMRD is also varied, and AMRD could be used in areas where they cause interferences to the land mobile service if AMRD and the land mobile service use the same frequency bands. The technical standards on AMRD are necessary in order to conduct sharing and compatibility studies, and these standards should cover the transmitting power and intervals, technologies used, message formats and so on. Meanwhile, it is necessary to find proper frequency bands for the application of AMRD, whether within or without the maritime mobile service frequency bands, without causing any interference to the existing services.

5/1.9.1/3.2 Existing relevant Recommendations and Reports are listed as follows:

Recommendations [ITU-R M.493-14](#), [ITU-R M.585-7](#), [ITU-R M.1371-5](#), WDPDN Report ITU-R M.[AMRD], WDPDN Report ITU-R M.[NEW_MARNUM] and WDPDN Recommendation ITU-R M.[AMRD].

5/1.9.1/3.3 Analyses on spectrum requirements

AMRD specified as Group A intended to be operated on frequencies of the current Radio Regulations (RR) Appendix 18. So, no additional spectrum requirement for this category of devices has been identified. However, this group will be restricted by the list of applications in new Recommendation ITU-R M.[AMRD].

For AMRD specified as Group B, the following spectrum requirements have been considered:

- Only one AIS channel is required to support AMRD applications. There is a low antenna height and the transmission power will be restricted to 1 W. A huge amount of AMRD in a certain area cannot be expected. It is unlikely to overload this 25 kHz channel;
- AMRD applications using other technologies require three 25 kHz channels. There is a low antenna height and the transmission power will be restricted to 1 W. If needed, channel sharing is necessary.

5/1.9.1/3.4 Appropriate frequency bands

Group A, AMRD that enhance the safety of navigation, are intended to use the frequencies of the current RR Appendix 18. These frequencies have been allocated for the operation of vessels.

Group B, AMRD that do not enhance the safety of navigation, but do operate in the maritime environment, should not be permitted to use the frequencies which cause any constraints on the existing mobile services. The signals or information originated by this group of AMRD do not concern the operation of vessels.

The part of the frequency range 156-162.05 MHz which is not channelized by RR Appendix 18 is already allocated to the fixed and mobile services, and these sub-bands are widely used by land mobile service in many countries. Especially, in some countries, these sub-bands are being used by public protection and disaster relief.

In RR Appendix **18**, the frequency 160.900 MHz (Ch. 2006) is already reserved for experimental use for future applications (see footnote *r*). This frequency is intended to be used solely by AIS-technology for AMRD Group B.

AMRD Group B using other technologies may be operated on the frequencies 161.525 MHz (Channel 2078), 161.550 MHz (Channel 2019) and 161.575 MHz (Channel 2079).

5/1.9.1/3.5 Analyses on device identification requirements

AMRD that are noted as Group A should use the numbering scheme given in Recommendation [ITU-R M.585-7](#) and the symbols given in Recommendation [ITU-R M.1371-5](#). Revisions of the recommendations might be necessary to display special AMRD on the ECDIS.

AMRD noted as Group B should use a new numbering system which is under development (WDPDN Report ITU-R M.[NEW_MARNUM]).

5/1.9.1/4 Methods to satisfy the agenda item

5/1.9.1/4.1 Autonomous maritime radio devices Group A

5/1.9.1/4.1.1 Method A

For the operation of AMRD Group A, it is proposed to amend footnote *f*) of RR Appendix **18** to allow AMRD Group A to operate on frequency channels 156.525 MHz (channel 70), 161.975 MHz (AIS 1) and 162.025 MHz (AIS 2).

5/1.9.1/4.2 Autonomous maritime radio devices Group B

In order to accommodate the variety of Group B AMRD technologies, the following methods are proposed:

5/1.9.1/4.2.1 Method B1

For operation of AMRD using AIS-technology, the frequency 160.900 MHz (Ch. 2006) (new AMRD AIS) is suggested to be used. This requires amendment to RR Appendix **18** footnote *r*) as appropriate. Such use should be in accordance with the latest version of Recommendation ITU-R M.[AMRD].

5/1.9.1/4.2.2 Method B2

AMRD Group B using other technologies than AIS technology may be operated on the frequencies 161.525 MHz (Channel 2078), 161.550 MHz (Channel 2019) and 161.575MHz (Channel 2079). This requires amendment to RR Appendix **18** footnote *mm*) as appropriate. Such use should be in accordance with the latest version of Recommendation ITU-R M.[AMRD].

5/1.9.1/4.2.3 Method B3

For AMRD Group B using non-AIS technology, this method proposes to modify the Radio Regulations to allow use of the frequency band 161.4375-161.4875 MHz, subject to causing no harmful interference to the existing services. Such use should be in accordance with the latest version of Recommendation ITU-R M.[AMRD].

5/1.9.1/5 Regulatory and procedural considerations

5/1.9.1/5.1 For Method A

MOD

APPENDIX 18 (REV.WRC-~~15~~19)

Table of transmitting frequencies in the VHF maritime mobile band

(See Article 52)

...

Notes referring to the Table

...

Specific notes

...

- f) The frequencies 156.300 MHz (channel 06), 156.525 MHz (channel 70), 156.800 MHz (channel 16), 161.975 MHz (AIS 1) and 162.025 MHz (AIS 2) may also be used by aircraft stations for the purpose of search and rescue operations and other safety-related communication. The frequencies 156.525 MHz (channel 70), 161.975 MHz (AIS 1) and 162.025 MHz (AIS 2) may also be used by autonomous maritime radio devices Group A for digital selective calling respectively AIS-technology. Such use should be in accordance with the most recent version of Recommendation ITU-R M.[AMRD]. (WRC-~~07~~19)

5/1.9.1/5.2 For Method B1

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APPENDIX 18 (REV.WRC-~~15~~19)

Table of transmitting frequencies in the VHF maritime mobile band

(See Article 52)

...

Notes referring to the Table

...

Specific notes

...

- r) In the maritime mobile service, this frequency is reserved for usage of autonomous maritime radio devices Group B using AIS-technology, experimental use for future applications or systems (e.g. new AIS applications, man over board systems, etc.). If authorized by administrations for experimental use, the operation shall not cause harmful interference to, or claim protection from, stations operating in the fixed and mobile services. Such use should be in accordance with the latest version of Recommendation ITU-R M.[AMRD]. (WRC-~~12~~19)

5/1.9.1/5.3 For Method B2

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APPENDIX 18 (REV.WRC-1519)

Table of transmitting frequencies in the VHF maritime mobile band

(See Article 52)

Notes referring to the Table

Specific notes

mm) Transmission on these channels is limited to coast stations. If permitted by administrations and specified by national regulations, these channels may be used by ship stations for transmission. All precautions should be taken to avoid harmful interference to channels AIS 1, AIS 2, 2027* and 2028*.

In addition channels 2078, 2019 and 2079 may also be used for AMRD Group B for non-AIS technologies as described in the most recent version of Recommendation ITU-R M.[AMRD], subject to coordination with affected administrations. (WRC-1519)

* From 1 January 2019, channel 2027 will be designated ASM 1 and channel 2028 will be designated ASM 2.

5/1.9.1/5.4 For Method B3

The possible modifications to the provisions of RR to satisfy the frequency need for AMRD are considered as follows:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD

148-161.9375 MHz

Allocation to services		
Region 1	Region 2	Region 3
156.8375-161.9375	156.8375-161.9375	
FIXED	FIXED	
MOBILE except aeronautical mobile	MOBILE	
5.226 ADD 5.A191	5.226 ADD 5.A191	

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ADD

5.A191 The frequency band 161.4375-161.4875 MHz can be used by Group B autonomous maritime radio devices using non-AIS technologies as described in the most recent version of Recommendation ITU-R M.[AMRD], subject to not causing harmful interference to the existing services. (WRC-19)

Agenda item 1.9.2

(WP 5B / WP 4C, WP 5A, WP 5C, (WP 1A), (WP 3M))

1.9 to consider, based on the results of ITU-R studies:

1.9.2 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);

Resolution 360 (Rev.WRC-15) – Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication

5/1.9.2/1 Executive summary

In accordance with Resolution 360 (Rev.WRC-15), the ITU-R has undertaken studies for possible new allocation to the maritime mobile-satellite service (MMSS) (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125-157.4375 MHz and 160.6125-162.0375 MHz of Radio Regulations (RR) Appendix 18.

The results of the sharing studies are contained in Recommendation ITU-R M.2092-0 which has been developed during the last study cycle and WDPDN Report ITU-R M.[VDES-SAT].

Based on the results of the studies, six methods have been developed to satisfy WRC-19 agenda item 1.9.2.

Method A

NOC to the Radio Regulations except suppression of Resolution 360 (Rev.WRC-15). This implies no allocation for the VHF data exchange (VDE) satellite component of the VHF data exchange system (VDES).

Method B

This method proposes new primary allocations for the MMSS (Earth-to-space and space-to-Earth), details for coordination of the VDES space stations with respect to terrestrial services are described below in the method section.

Method C

This method uses the same frequency plan as Method B but with new secondary allocation for the MMSS (Earth-to-space) and (space-to-Earth).

Due to the secondary allocation status for the VDES-SAT, there is no coordination between MMSS and terrestrial services and therefore there is no need to introduce a specific power flux-density (pfd) mask in the RR.

Method D

Same as Method C except with the addition of a pfd limit in RR Article 5 in order to protect the terrestrial service. The description of the pfd mask is given in the WDPND Report ITU-R M.[VDES-SAT]

Method E

This method is a variant of Method B but using a pfd mask different from that contained in Recommendation ITU-R M.2092. The description of the pfd mask is given in Appendix 2 of the WDPND Report ITU-R M.[VDES-SAT].

Method F

Similar to Method B with a different regulatory procedure (different frequency selection for satellite and terrestrial components of the VDES).

5/1.9.2/2 Background

The studies associated with WRC-15 agenda item 1.16 resulted in elaboration of a concept for the VDES reflected in Recommendation ITU-R M.2092-0. The system combines the current automatic identification system (AIS), applications specific messages (ASM) as well as data exchange terrestrial and satellite components.

During WRC-15, no allocations were made to VDES satellite component since the compatibility studies with the incumbent services in the frequency bands assumed for operation of VDES satellite component and in the adjacent frequency bands were incomplete.

To this effect, Resolution **360 (WRC-12)** was revised and updated to invite the WRC-19 to consider, based on the results of ITU-R studies, modifications of the Radio Regulations, including new spectrum allocations to the MMSS (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125-157.4375 MHz and 160.6125-162.0375 MHz of RR Appendix **18**, to enable a new VDES satellite component, while ensuring that this component will not degrade the current terrestrial VDES components, 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)**.

5/1.9.2/3 Summary and analysis of the results of ITU-R studies

5/1.9.2/3.1 Discussion on compatibility with incumbent services

Compatibility studies between satellite component of VDES and incumbent services have been performed. These studies are contained in the WDPND Report ITU-R M.[VDES-SAT], together with a summary of why a VDES satellite component is required, identification of the spectrum requirements and a technical description of the satellite component of VDES.

The compatibility between the downlink of the satellite component of VDES and mobile, as well as fixed, services has been evaluated by two study methodologies.

One methodology uses carrier-to-interference analysis to evaluate if the pfd mask contained in Recommendation ITU-R M.2092 provides protection for incumbent services. The interference analysis for fixed services uses bit-error ratio performance as specified in Recommendation ITU-R F.758 and C/(N+I) threshold for that bit-error ratio performance provided in Recommendation ITU-R F.1101. The interference analysis for mobile services uses signal-to-noise and distortion ratio (SINAD) threshold and bit-error ratio performance as specified in Recommendation ITU-R M.1808.

The other methodology uses interference-to-noise analysis based on a protection criteria of $I/N = -6$ dB, specified in Recommendation ITU-R M.1808 and Recommendation ITU-R F.758.

The two study methodologies lead to different pfd masks, as they are based on different assumptions as mentioned above, that provide compatibility with incumbent fixed and mobile services.

One study on compatibility between the VDE-SAT uplink and the land mobile service indicates that VDES satellite receiver can suffer interference caused by stations in the terrestrial services. Another study, which is supported by measurements, indicate compatibility between the VDE-SAT uplink and the land mobile service when using the most robust waveform.

5/1.9.2/3.2 Frequency plans

The following three frequency plans are being studied in working document towards a PDN Report ITU-R M.[VDES-SAT]. The proposed methods refer only to frequency plan alternatives 2 and 3.

5/1.9.2/3.2.1 Frequency plan alternative 1

Frequency plan alternative 1 allows for utilization of the channels 24, 84, 25, 85, 26 and 86 of RR Appendix 18 in a shared manner between VDE-TER and VDE-SAT.

- Four channels 1024, 1084, 1025 and 1085 are shared between ship-to-shore and ship-to-satellite (VDE-SAT uplink) services.
- Two channels 1026 and 1086 are exclusively reserved for ship-to-satellite (VDE-SAT uplink) services.
- Four channels 2024, 2084, 2025 and 2085 are shared among shore-to-ship, ship-to-ship and satellite-to-ship (VDE-SAT downlink) services.
- Two channels 2026 and 2086 are exclusively reserved for satellite-to-ship (VDE-SAT downlink) services.

5/1.9.2/3.2.2 Frequency plan alternative 2

Frequency plan alternative 2 allows for utilization of channels 24, 84, 25 and 85 primarily for VHF data exchange terrestrial (VDE-TER), while channels 26 and 86 are, within the context of VDES, exclusively reserved for VHF data exchange satellite (VDE-SAT) uplink. VDE-SAT uplink is also possible in channels 24, 84, 25 and 85, but the VDE-SAT uplink in these channels do not impose constraints on VDE-TER. Frequencies are, within the context of VDES, exclusively reserved for VDE-SAT downlink within the frequency range 160.9625 MHz to 161.4875 MHz, which is not channelized in RR Appendix 18.

- Four channels 1024, 1084, 1025 and 1085 are reserved for ship-to-shore services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on ship-to-shore services.
- Four channels 2024, 2084, 2025 and 2085 are reserved for shore-to-ship and ship-to-ship services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on shore-to-ship and ship-to-ship services.
- Four channels 1026, 1086, 2026 and 2086 are exclusively reserved for ship-to-satellite (VDE-SAT uplink) services.
- Frequencies are exclusively reserved for satellite-to-ship (VDE-SAT downlink) services within the frequency range 160.9625 MHz to 161.4875 MHz, which is not channelized in RR Appendix 18.

5/1.9.2/3.2.3 Frequency plan alternative 3

Frequency plan alternative 3 allows for utilization of the channels 24, 84, 25 and 85 in a shared manner between VDE-TER and VDE-SAT, while channels 26 and 86 exclusively reserved for VDE-SAT.

- Four channels 1024, 1084, 1025 and 1085 are shared between ship-to-shore, ship-to-ship, shore-to-ship and ship-to-satellite (VDE-SAT uplink) services.
- Two channels 1026 and 1086 are exclusively reserved for ship-to-satellite (VDE-SAT uplink) services.
- Four channels 2024, 2084, 2025 and 2085 are primarily for the satellite-to-ship (VDE-SAT downlink) service, while shore-to-ship services are possible without imposing constraints on satellite-to-ship services.
- Two channels 2026 and 2086 are exclusively reserved for satellite-to-ship (VDE-SAT downlink) services.

5/1.9.2/3.3 Existing relevant Recommendations and Reports are listed as follows:

Recommendations [ITU-R F.758](#), [ITU-R F.1101](#), [ITU-R M.1084](#), [ITU-R M.1808](#), [ITU-R M.1842](#), [ITU-R M.2092](#), WDPDN Report ITU-R M.[VDES-SAT].

5/1.9.2/4 Methods to satisfy the agenda item

5/1.9.2/4.1 Method A

Due to the sharing difficulties of the VDES satellite component uplink and downlink with the systems in the land mobile service, it is proposed to make no changes in the Radio Regulations except suppression of Resolution **360 (Rev.WRC-15)**.

5/1.9.2/4.2 Method B

This method is based on frequency plan alternative 2 and proposes a new primary allocation for the MMSS (Earth-to-space) in the frequency band 157.1875-157.3375 MHz (channels 1024, 1084, 1025, 1085, 1026 and 1086) and the frequency band 161.7875-161.9375 (channels 2026 and 2086). The channels 1026, 1086, 2026 and 2086 are exclusively reserved for ship-to-satellite (VDE-SAT uplink) services. The channels 1024, 1084, 1025 and 1085 are reserved for ship-to-shore services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on ship-to-shore services.

The method proposes a new primary allocation for the MMSS (space-to-Earth) for frequency band 160.9625-161.4875 MHz, for improved VDE communication capacity and coverage.

Coordination of VDE space stations of the MMSS (space-to-Earth) with respect to terrestrial services is described in modification of RR Appendix 5, taking into account the pfd mask defined at the last study cycle in Recommendation ITU-R M.2092-0.

It is proposed also to clarify that the coordination between MMSS and terrestrial services is subject to the application of the provisions of RR No. **9.14**.

The method proposes to modify provisions RR Nos. **5.208A** and **5.208B** in order to ensure the protection of the radio astronomy service (RAS) in the nearest frequency band.

In order to protect the RAS, Annex 1 to Resolution **739 (Rev.WRC-07)** is revised to include MMSS in the frequency band 160.9625-161.4875 MHz.

5/1.9.2/4.3 Method C

This method is based on frequency plan alternative 2 and proposes a new secondary allocation for the MMSS (Earth-to-space) in the frequency band 157.1875-157.3375 MHz (channels 1024, 1084, 1025, 1085, 1026 and 1086) and the frequency band 161.7875-161.9375 (channels 2024, 2084, 2025, 2085, 2026 and 2086). The channels 1026, 1086, 2026 and 2086 are exclusively reserved for ship-to-satellite (VDE-SAT uplink) services. The channels 1024, 1084, 1025 and 1085 are reserved for ship-to-shore services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on ship-to-shore services.

The method proposes a new secondary allocation for the MMSS (space-to-Earth) in the frequency band 160.9625-161.4875 MHz, for improved VDE communication capacity and coverage.

The method proposes to modify provisions RR Nos. **5.208A** and **5.208B** in order to ensure the protection of the RAS in the nearest frequency band.

In order to protect the RAS, Annex 1 to Resolution **739 (Rev.WRC-07)** is revised to include MMSS in the frequency band 160.9625-161.4875 MHz.

Due to the proposed secondary allocation status for the VDES-SAT, there is no coordination between MMSS and terrestrial services and therefore there is no need to introduce a specific pfd mask in the RR.

5/1.9.2/4.4 Method D

This method is based on frequency plan alternative 2 and proposes, in addition to regulatory changes in method C, to introduce pfd limits for VDE-SAT downlink which are based on *I/N* protection criteria.

5/1.9.2/4.5 Method E

This method is based on frequency plan alternative 2 and proposes a variant of Method B but using a pfd mask different from that contained in ITU-R M.2092. The description of the pfd mask is given in Appendix 2 of WDPDN Report ITU-R M.[VDES-SAT].

5/1.9.2/4.6 Method F

This method is based on frequency plan alternative 3 and proposes a new primary allocation for the MMSS (Earth-to-space) in the frequency band 157.1875-157.3375 MHz (channels 1024, 1084, 1025, 1085, 1026 and 1086 of RR Appendix **18**).

The method proposes a new primary allocation for the MMSS (space-to-Earth) in the frequency band 161.7875-161.9375 MHz (channels 2024, 2084, 2025, 2085, 2026 and 2086 of RR Appendix **18**), for improved VDE communication capacity and coverage.

To avoid complexity in sharing between VDES satellite downlink and VDES terrestrial communication, when introducing VDES satellite component, the method proposes to change the frequency plan of VDES terrestrial communication as follows.

- RR Appendix **18** lower legs (channels 1024, 1084, 1025, 1085) are for ship-to-shore, shore-to-ship and ship-to-ship VDE.
- RR Appendix **18** upper legs (channels 2024, 2084, 2025, 2085) are for shore-to-ship VDE when satellite downlink is not available.

The method proposes to modify provisions of RR Nos. **5.208A** and No. **5.208B** in order to ensure the protection of the RAS in the nearest frequency band. In order to protect the RAS, Annex 1 to Resolution **739 (Rev.WRC-15)** would be revised to include MMSS in the frequency band 161.7875-161.9375 MHz.

The method proposes to add provision RR No. **5.226B** in order to ensure the coordination of terrestrial services in the same frequency band. Coordination of VDE space stations of the MMSS (space-to-Earth) with respect to terrestrial services is described in modification of RR Appendix 5, proposing a pfd mask.

5/1.9.2/5 Regulatory and procedural considerations

5/1.9.2/5.1 For Method A

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations (See No. 2.1)

NOC

148–161.9375 MHz

Allocation to services		
Region 1	Region 2	Region 3
156.8375-161.9375	156.8375-161.9375	
FIXED	FIXED	
MOBILE except aeronautical mobile	MOBILE	
5.226	5.226	

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SUP

RESOLUTION 360 (REV.WRC-15)

Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication

Reasons: It is proposed to suppress Resolution **360 (Rev.WRC-15)** since it will become superfluous after the studies are completed.

5/1.9.2/5.2 For Methods B and E

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations (See No. 2.1)

MOD

148-161.9375 MHz

Allocation to services		
Region 1	Region 2	Region 3
156.8375-161.9375 <u>157.1875</u> FIXED MOBILE except aeronautical mobile 5.226	156.8375-161.9375 <u>157.1875</u> FIXED MOBILE	
156.8375 <u>157.1875-161.9375<u>157.3375</u> FIXED MOBILE except aeronautical mobile <u>MARITIME MOBILE-SATELLITE (Earth-to-space)</u> 5.226 <u>ADD 5.226A</u></u>	156.8375 <u>157.1875-161.9375<u>157.3375</u> FIXED MOBILE <u>MARITIME MOBILE-SATELLITE (Earth-to-space)</u> 5.226 <u>ADD 5.226A</u></u>	
156.8375 <u>157.3375-161.9375<u>160.9625</u> FIXED MOBILE except aeronautical mobile 5.226</u>	156.8375 <u>157.3375-161.9375<u>160.9625</u> FIXED MOBILE 5.226</u>	
156.8375 <u>160.9625-161.9375</u> <u>161.4875</u> FIXED MOBILE except aeronautical mobile <u>MARITIME MOBILE-SATELLITE (space-to-Earth)</u> <u>MOD 5.208A MOD 5.208B</u> 5.226 <u>ADD 5.226B</u>	156.8375 <u>160.9625-161.9375</u> <u>161.4875</u> FIXED MOBILE <u>MARITIME MOBILE-SATELLITE (space-to-Earth)</u> <u>MOD 5.208A MOD 5.208B</u> 5.226 <u>ADD 5.226B</u>	
156.8375 <u>161.4875-161.9375</u> <u>161.7875</u> FIXED MOBILE except aeronautical mobile 5.226	156.8375 <u>161.4875-161.9375</u> <u>161.7875</u> FIXED MOBILE 5.226	
156.8375 <u>161.7875-161.9375</u> FIXED MOBILE except aeronautical mobile <u>MARITIME MOBILE-SATELLITE (Earth-to-space)</u> 5.226 <u>ADD 5.226A</u>	156.8375 <u>161.7875-161.9375</u> FIXED MOBILE <u>MARITIME MOBILE-SATELLITE (Earth-to-space)</u> 5.226 <u>ADD 5.226A</u>	

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ADD

5.226A The use of the frequency bands 157.1875-157.3375 MHz and 161.7875-161.9375 MHz by the maritime mobile-satellite (Earth-to-space) service is limited to the systems which operate in accordance with Appendix 18. (WRC-19)

ADD

5.226B The use of the frequency band 160.9625-161.4875 MHz by the maritime mobile-satellite (space-to-Earth) service is limited to the systems which operate in accordance with Appendix 18. Such use is subject to the application of the provisions of No. 9.14 for coordination with stations of terrestrial services. (WRC-19)

Reasons: The above modifications of RR Article 5 identify a MMSS allocation uplink and downlink for the VHF Data Exchange System which is described in the WDPDN Report ITU-R M.[VDES-SAT]. It is also clarified, in the footnote RR No. 5.226B, that the coordination between MMSS and terrestrial services is subject to the application of the provision of RR No. 9.14.

MOD

5.208A In making assignments to space stations in the mobile-satellite service in the bands 137-138 MHz, 387-390 MHz, ~~and 400.15-401 MHz~~ [and in the maritime-mobile satellite service \(space-to-Earth\) in the band 160.9625-161.4875 MHz](#), administrations shall take all practicable steps to protect the radio astronomy service in the bands 150.05-153 MHz, 322-328.6 MHz, 406.1-410 MHz and 608-614 MHz from harmful interference from unwanted emissions. The threshold levels of interference detrimental to the radio astronomy service are shown in the relevant ITU-R Recommendation. (WRC-~~07~~19)

MOD

5.208B* In the frequency bands:

- 137-138 MHz,
- [160.9625-161.4875 MHz](#),
- 387-390 MHz,
- 400.15-401 MHz,
- 1 452-1 492 MHz,
- 1 525-1 610 MHz,
- 1 613.8-1 626.5 MHz,
- 2 655-2 690 MHz,
- 21.4-22 GHz,

Resolution 739 (Rev.WRC-~~15~~19) applies. (WRC-~~15~~19)

* This provision was previously numbered as No. 5.347A. It was renumbered to preserve the sequential order.

MOD

APPENDIX 18 (REV.WRC-~~15~~19)

Table of transmitting frequencies in the VHF maritime mobile band

(See Article 52)

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From ship stations	From coast stations		Single frequency	Two frequency	
24	w), ww), x), xx)	157.200	161.800		x	x	x
1024	w), ww), x), xx), AAA)	157.200					
2024	w), ww), x), xx), AAA)	161.800	161.800	x (digital only)			
84	w), ww), x), xx)	157.225	161.825		x	x	x
1084	w), ww), x), xx), AAA)	157.225					
2084	w), ww), x), xx), AAA)	161.825	161.825	x (digital only)			
25	w), ww), x), xx)	157.250	161.850		x	x	x
1025	w), ww), x), xx), AAA)	157.250					
2025	w), ww), x), xx), AAA)	161.850	161.850	x (digital only)			
85	w), ww), x), xx)	157.275	161.875		x	x	x
1085	w), ww), x), xx), AAA)	157.275					
2085	w), ww), x), xx), AAA)	161.875	161.875	x (digital only)			
26	w), ww), x)	157.300	161.900		x	x	x
1026	w), ww), x), AAA)	157.300					
2026	w), ww), x), AAA)		161.900				
86	w), ww), x)	157.325	161.925		x	x	x

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From ship stations	From coast stations		Single frequency	Two frequency	
1086	w), ww), x) ₁ AAA	157.325					
2086	w), ww), x) ₂ AAA		161.925				
27	z), zx)	157.350	161.950			x	x
1027	z), zz)	157.350	157.350		x		
2027* ASM 1	z)	161.950	161.950				
87	z), zz)	157.375	157.375		x		
28	z), zx)	157.400	162.000			x	x
1028	z), zz)	157.400	157.400		x		
2028* ASM 2	z)	162.000	162.000				
88	z), zz)	157.425	157.425		x		
AIS 1	f), l), p)	161.975	161.975				
AIS 2	f), l), p)	162.025	162.025				

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* From 1 January 2019, channel 2027 will be designated ASM 1 and channel 2028 will be designated ASM 2.

Notes referring to the Table

...

Specific notes

...

w) In Regions 1 and 3:

Until 1 January 2017, the frequency bands 157.200-157.325 MHz and 161.800-161.925 MHz (corresponding to channels: 24, 84, 25, 85, 26 and 86) may be used for digitally modulated emissions, subject to coordination with affected administrations. Stations using these channels or frequency bands for digitally modulated emissions shall not cause harmful interference to, or claim protection from, other stations operating in accordance with Article 5.

From 1 January 2017, the frequency bands 157.200-157.325 MHz and 161.800-161.925 MHz (corresponding to channels: 24, 84, 25, 85, 26 and 86) are identified for the utilization of the VHF Data Exchange System (VDES) described in the most recent version of Recommendation ITU-R M.2092. These frequency bands may also be used for analogue modulation described in the most recent version of Recommendation ITU-R M.1084 by an administration that wishes to do so, subject to not causing harmful interference to, or claiming protection from other stations in the maritime mobile service using digitally modulated emissions and subject to coordination with affected administrations. (WRC-15¹⁹)

wa) In Regions 1 and 3:

Until 1 January 2017, the frequency bands 157.025-157.175 MHz and 161.625-161.775 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23 and 83) may be used for digitally modulated emissions, subject to coordination with affected administrations. Stations using these channels or frequency bands for digitally modulated emissions shall not cause harmful interference to, or claim protection from, other stations operating in accordance with Article 5.

From 1 January 2017, the frequency bands 157.025-157.100 MHz and 161.625-161.700 MHz (corresponding to channels: 80, 21, 81 and 22) are identified for utilization of the digital systems described in the most recent version of Recommendation ITU-R M.1842 using multiple 25 kHz contiguous channels.

From 1 January 2017, the frequency bands 157.150-157.175 MHz and 161.750-161.775 MHz (corresponding to channels: 23 and 83) are identified for utilization of the digital systems described in the most recent version of Recommendation ITU-R M.1842 using two 25 kHz contiguous channels. From 1 January 2017, the frequencies

157.125 MHz and 161.725 MHz (corresponding to channel: 82) are identified for the utilization of the digital systems described in the most recent version of Recommendation ITU-R M.1842.

The frequency bands 157.025-157.175 MHz and 161.625-161.775 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23 and 83) can also be used for analogue modulation described in the most recent version of Recommendation ITU-R M.1084 by an administration that wishes to do so, subject to not claiming protection from other stations in the maritime mobile service using digitally modulated emissions and subject to coordination with affected administrations. (WRC-~~15~~19)

...

- xx) ~~From 1 January 2019, the~~The channels 24, 84, 25 and 85 may be merged in order to form a unique duplex channels with a bandwidth of 100 kHz in order to operate the VDES terrestrial component described in the most recent version of Recommendation ITU-R M.2092. (WRC-~~15~~19)

...

- z) ~~Until 1 January 2019, these channels may be used for possible testing of future AIS applications without causing harmful interference to, or claiming protection from, existing applications and stations operating in the fixed and mobile services.~~

~~From 1 January 2019, these~~These channels are each split into two simplex channels. The channels 2027 and 2028 designated as ASM 1 and ASM 2 are used for application specific messages (ASM) as described in the most recent version of Recommendation ITU-R M.2092. (WRC-~~15~~19)

...

- zz) ~~From 1 January 2019, The~~ channels 1027, 1028, 87 and 88 are used as single-frequency analogue channels for port operation and ship movement. (WRC-~~15~~19)

AAA) These channels which are also allocated to the maritime mobile-satellite service (Earth-to-space), shall be used for the reception of VDES messages from ships as described in the most recent version of Recommendation ITU-R M.2092 in the following way:

- The channels 1024, 1084, 1025 and 1085 are reserved for ship-to-shore services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on ship-to-shore services.
- The channels 2024, 2084, 2025 and 2085 are reserved for shore-to-ship and ship-to-ship services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on shore-to-ship and ship-to-ship services.
- The channels 1026, 1086, 2026 and 2086 are exclusively reserved for ship-to-satellite (VDE-SAT uplink) services. (WRC-19)

Reasons: The channels are identified for the satellite uplink of the VDES.

MOD

RESOLUTION 739 (REV.WRC-1519)

Compatibility between the radio astronomy service and the active space services in certain adjacent and nearby frequency bands

The World Radiocommunication Conference ([Geneva, 2007](#)[Sharm el-Sheikh, 2019](#)),

...

ANNEX 1 TO RESOLUTION 739 (REV.WRC-1519)

Unwanted emission threshold levels

TABLE 1-2

epfd thresholds⁽¹⁾ for unwanted emissions from all space stations of a non-GSO satellite system at a radio astronomy station

Space service	Space service band	Radio astronomy band	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by the Bureau following the entry into force of the Final Acts of:
			epfd ⁽²⁾	Reference bandwidth	epfd ⁽²⁾	Reference bandwidth	epfd ⁽²⁾	Reference bandwidth	
	(MHz)	(MHz)	(dB(W/m ²))	(MHz)	(dB(W/m ²))	(kHz)	(dB(W/m ²))	(kHz)	
MSS (space-to-Earth)	137-138	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-07
MMSS (space-to-Earth)	160.9625-161.4875	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-19
MSS (space-to-Earth)	387-390	322-328.6	-240	6.6	-255	10	-228	10	WRC-07
MSS (space-to-Earth)	400.15-401	406.1-410	-242	3.9	NA	NA	NA	NA	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 400-1 427	-243	27	-259	20	-229	20	WRC-07
RNSS (space-to-Earth) ⁽³⁾	1 559-1 610	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 613.8-1 626.5	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-03

SUP

RESOLUTION 360 (REV.WRC-15)

Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication

Reasons: It is proposed to suppress Resolution **360 (Rev.WRC-15)** since it will become superfluous after the studies are completed and the identification of frequencies in order to enhance maritime radiocommunications has been made by WRC-19.

5/1.9.2/5.2.1 For Method B

MOD

APPENDIX 5 (REV.WRC-15~~19~~)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

ANNEX 1

MOD

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-15~~19~~)

MOD

1.1 Below 1 GHz*

1.1.4 [In the band 160.9625-161.4875 MHz, coordination of a space station of the maritime mobile-satellite service \(space-to-Earth\) with respect to terrestrial services is required only if the power spectral and flux-density produced by this space station exceeds the following mask in dB\(W/\(m² · 4 kHz\)\) at the Earth's surface:](#)

* These provisions apply only to the MSS.

$$PF D(\theta^{\circ})_{((dBW/m^2 \cdot 4 \text{ kHz}))} = \begin{cases} -149 + 0.16 * \theta^{\circ} & 0^{\circ} \leq \theta < 45^{\circ}; \\ -142 + 0.53 * (\theta^{\circ} - 45^{\circ}) & 45^{\circ} \leq \theta < 60^{\circ}; \\ -134 + 0.1 * (\theta^{\circ} - 60^{\circ}) & 60^{\circ} \leq \theta \leq 90^{\circ}. \end{cases}$$

where θ is the angle of arrival of the incident wave above the horizontal plane (degrees).

Reasons: It is proposed to extend the coordination threshold defined in Annex 1 of RR Appendix 5 for the VDES using the frequency band 160.9625-161.4875 MHz by using the pfd mask defined in the Recommendation ITU-R M.2092-0.

5/1.9.2/5.2.2 For Method E

MOD

APPENDIX 5 (REV.WRC-1519)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

ANNEX 1

MOD

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-1519)

MOD

1.1 Below 1 GHz*

1.1.4 In the band 160.9625-161.4875 MHz, coordination of a space station of the maritime mobile-satellite service (space-to-Earth) with respect to terrestrial services is required only if the power spectral and flux-density produced by this space station exceeds the following mask in dB(W/(m² · 4 kHz)) at the Earth's surface:

* These provisions apply only to the MSS.

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$$pfd(\theta^\circ) \text{ (dBW/(m}^2\text{*4 kHz))} = \begin{cases} -141.72 - 8.15 + 12 \left(\frac{\theta}{16.47} \right)^2 & 0^\circ \leq \theta < 8.5^\circ \\ -149 + 0.16 * \theta^\circ & 8.5^\circ \leq \theta < 45^\circ \\ -142 + 0.53 * (\theta^\circ - 45^\circ) & 45^\circ \leq \theta < 58.5^\circ \\ -141.72 + 6.85 - 10 \log_{10} \left(\left(\frac{\theta}{16.47} \right)^{-1.5} + k \right) & 58.5^\circ \leq \theta \leq 90^\circ \end{cases}$$

where θ is the angle of arrival of the incident wave above the horizontal plane (degrees).

5/1.9.2/5.3 For Methods C and D

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

148-161.9375 MHz

Allocation to services		
Region 1	Region 2	Region 3
156.8375-161.9375 157.1875	156.8375-161.9375 157.1875	
FIXED	FIXED	
MOBILE except aeronautical mobile	MOBILE	
5.226	5.226	
156.8375 157.1875- 161.9375 157.3375	156.8375 157.1875- 161.9375 157.3375	
FIXED	FIXED	
MOBILE except aeronautical mobile	MOBILE	
Maritime mobile-satellite (Earth-to-space) ADD 5.226A	Maritime mobile-satellite (Earth-to-space) ADD 5.226A	
5.226	5.226	
156.8375 157.3375- 161.9375 160.9625	156.8375 157.3375- 161.9375 160.9625	
FIXED	FIXED	
MOBILE except aeronautical mobile	MOBILE	
5.226	5.226	

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156.8375-160.9625-161.9375-161.4875	156.8375-160.9625-161.9375-161.4875
FIXED	FIXED
MOBILE except aeronautical mobile	MOBILE
Maritime mobile-satellite (space-to-Earth) MOD 5.208A, MOD 5.208B, ADD 5.226B	Maritime mobile-satellite (space-to-Earth) MOD 5.208A, MOD 5.208B, ADD 5.226B
5.226	5.226
156.8375-161.4875-161.9375-161.7875	156.8375-161.4875-161.9375-161.7875
FIXED	FIXED
MOBILE except aeronautical mobile	MOBILE
5.226	5.226
156.8375-161.7875-161.9375	156.8375-161.7875-161.9375
FIXED	FIXED
MOBILE except aeronautical mobile	MOBILE
Maritime mobile-satellite (Earth-to-space) ADD 5.226A	Maritime mobile-satellite (Earth-to-space) ADD 5.226A
5.226	5.226

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ADD

5.226A The use of the frequency bands 157.1875-157.3375 MHz and 161.7875-161.9375 MHz by the maritime mobile-satellite (Earth-to-space) service is limited to non-GSO systems which operate in accordance with Appendix 18. (WRC-19)

Reasons: The above modification of RR Article 5 specify that the MMSS allocation (Earth-to-space) for the VDES satellite component as described in the WDPDN Report ITU-R M.[VDES-SAT] should operate in accordance with RR Appendix 18.

MOD

5.208A In making assignments to space stations in the mobile-satellite service in the bands 137-138 MHz, 387-390 MHz and 400.15-401 MHz and in the maritime-mobile satellite service (space-to-Earth) in the band 160.9625-161.4875 MHz, administrations shall take all practicable steps to protect the radio astronomy service in the bands 150.05-153 MHz, 322-328.6 MHz, 406.1-410 MHz and 608-614 MHz from harmful interference from unwanted emissions. The threshold levels of interference detrimental to the radio astronomy service are shown in the relevant ITU-R Recommendation. (WRC-0719)

Reasons: The above modification is proposed to ensure the protection of the radio astronomy service (RAS).

MOD

5.208B* In the frequency bands:
 137-138 MHz,
160.9625-161.4875 MHz,
 387-390 MHz,
 400.15-401 MHz,
 1 452-1 492 MHz,
 1 525-1 610 MHz,
 1 613.8-1 626.5 MHz,
 2 655-2 690 MHz,
 21.4-22 GHz,

Resolution **739 (Rev.WRC-1519)** applies. (WRC-1519)

Reasons: The above modification is proposed to ensure the protection of the radio astronomy service (RAS).

MOD

APPENDIX 18 (REV.WRC-1519)

Table of transmitting frequencies in the VHF maritime mobile band

(See Article 52)

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From ship stations	From coast stations		Single frequency	Two frequency	
24	w), ww), x), xx)	157.200	161.800		x	x	x
1024	w), ww), x), xx), <u>AAA</u>)	157.200					
2024	w), ww), x), xx), <u>AAA</u>)	161.800	161.800	x (digital only)			
84	w), ww), x), xx)	157.225	161.825		x	x	x
1084	w), ww), x), xx), <u>AAA</u>)	157.225					
2084	w), ww), x), xx), <u>AAA</u>)	161.825	161.825	x (digital only)			
25	w), ww), x), xx)	157.250	161.850		x	x	x

* This provision was previously numbered as No. **5.347A**. It was renumbered to preserve the sequential order.

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Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From ship stations	From coast stations		Single frequency	Two frequency	
1025	w), ww), x), xx), <u>AAA</u>	157.250					
2025	w), ww), x), xx), <u>AAA</u>	161.850	161.850	x (digital only)			
85	w), ww), x), xx)	157.275	161.875		x	x	x
1085	w), ww), x), xx), <u>AAA</u>	157.275					
2085	w), ww), x), xx), <u>AAA</u>	161.875	161.875	x (digital only)			
26	w), ww), x)	157.300	161.900		x	x	x
1026	w), ww), x), <u>AAA</u>	157.300					
2026	w), ww), x), <u>AAA</u>		161.900				
86	w), ww), x)	157.325	161.925		x	x	x
1086	w), ww), x), <u>AAA</u>	157.325					
2086	w), ww), x), <u>AAA</u>		161.925				
27	z), zx)	157.350	161.950			x	x
1027	z), zz)	157.350	157.350		x		
<u>2027*</u> <u>ASM 1</u>	z)	161.950	161.950				
87	z), zz)	157.375	157.375		x		
28	z), zx)	157.400	162.000			x	x
1028	z), zz)	157.400	157.400		x		
<u>2028*</u> <u>ASM 2</u>	z)	162.000	162.000				
88	z), zz)	157.425	157.425		x		
AIS 1	f), l), p)	161.975	161.975				
AIS 2	f), l), p)	162.025	162.025				

* From 1 January 2019, channel 2027 will be designated ASM 1 and channel 2028 will be designated ASM 2.

Notes referring to the Table

...

Specific notes

...

- m) These channels may be operated as single frequency channels, subject to coordination with affected administrations. The following conditions apply for single frequency usage:
- The lower frequency portion of these channels may be operated as single frequency channels by ship and coast stations.
 - Transmission using the upper frequency portion of these channels is limited to coast stations.
 - If permitted by administrations and specified by national regulations, the upper frequency portion of these channels may be used by ship stations for transmission. All precautions should be taken to avoid harmful interference to channels AIS 1, AIS 2, 2027*ASM 1 and 2028*ASM 2. (WRC-1519)

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AAA) These channels may be used in the maritime mobile-satellite service (Earth-to-space) by the VDES satellite component in the following way:

- The channels 1024, 1084, 1025 and 1085 are reserved for ship-to-shore services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on ship-to-shore services.
- The channels 2024, 2084, 2025 and 2085 are reserved for shore-to-ship and ship-to-ship services, but ship-to-satellite (VDE-SAT uplink) services are possible without imposing constraints on shore-to-ship and ship-to-ship services.
- The channels 1026, 1086, 2026 and 2086 are exclusively reserved for ship-to-satellite (VDE-SAT uplink) services. (WRC-19)

Reasons: To update the Radio Regulations.

MOD

RESOLUTION 739 (REV.WRC-1519)

Compatibility between the radio astronomy service and the active space services in certain adjacent and nearby frequency bands

The World Radiocommunication Conference (Geneva, 2015) [Sharm el-Sheikh, 2019](#),

ANNEX 1 TO RESOLUTION 739 (REV.WRC-1519)

Unwanted emission threshold levels

TABLE 1-2

epfd thresholds⁽¹⁾ for unwanted emissions from all space stations of a non-GSO satellite system at a radio astronomy station

Space service	Space service band	Radio astronomy band	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by the Bureau following the entry into force of the Final Acts of:
			epfd ⁽²⁾	Reference bandwidth	epfd ⁽²⁾	Reference bandwidth	epfd ⁽²⁾	Reference bandwidth	
	(MHz)	(MHz)	(dB(W/m ²))	(MHz)	(dB(W/m ²))	(kHz)	(dB(W/m ²))	(kHz)	
MSS (space-to-Earth)	137-138	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-07
MMSS (space-to-Earth)	160.9625-161.4875	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-19
MSS (space-to-Earth)	387-390	322-328.6	-240	6.6	-255	10	-228	10	WRC-07
MSS (space-to-Earth)	400.15-401	406.1-410	-242	3.9	NA	NA	NA	NA	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 400-1 427	-243	27	-259	20	-229	20	WRC-07
RNSS (space-to-Earth) ⁽³⁾	1 559-1 610	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 613.8-1 626.5	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-03

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SUP

RESOLUTION 360 (REV.WRC-15)

Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication

Reasons: It is proposed to suppress Resolution **360 (Rev.WRC-15)** since it will become superfluous after the studies are completed and the identification of frequencies in order to enhance maritime radiocommunications has been made by WRC-19.

5/1.9.2/5.3.1 For Method C

ADD

5.226B The use of the frequency band 160.9625-161.4875 MHz by the maritime mobile-satellite (space-to-Earth) service is limited to non-GSO systems. (WRC-19)

Reasons: The above modification of RR Article **5** specify that the MMSS allocation (space-to-Earth) for the VDES satellite component as described in the WDPDN Report ITU-R M.[VDES-SAT] should be limited to non-GSO systems.

5/1.9.2/5.3.2 For Method D

ADD

5.226B The use of the frequency band 160.9625-161.4875 MHz by the maritime mobile-satellite (space-to-Earth) service is limited to the non-GSO systems. In that band, the power flux-density at the surface of the Earth produced by emissions from transmitting stations of the maritime mobile-satellite (space-to-Earth) service shall not exceed $-172.3 \text{ dB(W/m}^2\text{)}$ for $0^\circ \leq \theta < 5^\circ$, $-172.3 + 0.45 (\theta - 5) \text{ dB(W/m}^2\text{)}$ for $5^\circ \leq \theta < 25^\circ$ and $-163.3 \text{ dB(W/m}^2\text{)}$ for $25^\circ \leq \theta \leq 90^\circ$, where θ is the angle of arrival of the radio-frequency wave and the reference bandwidth is 4 kHz. (WRC-19)

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ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD

148-161.9375 MHz

Allocation to services		
Region 1	Region 2	Region 3
156.8375-161.9375 <u>157.1875</u> FIXED MOBILE except aeronautical mobile 5.226	156.8375-161.9375 <u>157.1875</u> FIXED MOBILE 5.226	
156.8375 <u>157.1875-161.9375</u> <u>157.3375</u> FIXED MOBILE except aeronautical mobile <u>MARITIME MOBILE-SATELLITE (Earth-to-space)</u> 5.226 <u>ADD 5.226A</u>	156.8375 <u>157.1875-161.9375</u> <u>157.3375</u> FIXED MOBILE <u>MARITIME MOBILE-SATELLITE (Earth-to-space)</u> 5.226 <u>ADD 5.226A</u>	
156.8375 <u>157.3375-161.9375</u> <u>161.7875</u> FIXED MOBILE except aeronautical mobile 5.226	156.8375 <u>157.3375-161.9375</u> <u>161.7875</u> FIXED MOBILE 5.226	
156.8375 <u>161.7875-161.9375</u> FIXED MOBILE except aeronautical mobile 5.226 <u>ADD 5.226B</u>	156.8375 <u>161.7875-161.9375</u> FIXED MOBILE <u>MARITIME MOBILE-SATELLITE (space-to-Earth)</u> <u>MOD 5.208A MOD 5.208B</u> 5.226 <u>ADD 5.226B</u>	

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Reasons: The above modifications of RR Article 5 identify a MMSS allocation uplink and downlink for the VHF Data Exchange System which is described in Recommendation ITU-R M.2092-0.

MOD

5.208A In making assignments to space stations in the mobile-satellite service in the bands 137-138 MHz, 387-390 MHz, ~~and~~ 400.15-401 MHz and in the maritime-mobile-satellite service (space-

to-Earth) in the band **161.7875-161.9375 MHz**, administrations shall take all practicable steps to protect the radio astronomy service in the bands 150.05-153 MHz, 322-328.6 MHz, 406.1-410 MHz and 608-614 MHz from harmful interference from unwanted emissions. The threshold levels of interference detrimental to the radio astronomy service are shown in the relevant ITU-R Recommendation. (WRC-0719)

Reasons: The frequency range 161.7875-161.9375 MHz is a new allocation to the maritime mobile-satellite service (space-to-Earth). To ensure protection of the RAS this frequency range has to be added to RR No. **5.208A**.

MOD

5.208B* In the frequency bands:

137-138 MHz,
161.7875-161.9375 MHz,
387-390 MHz,
400.15-401 MHz,
1 452-1 492 MHz,
1 525-1 610 MHz,
1 613.8-1 626.5 MHz,
2 655-2 690 MHz,
21.4-22 GHz,

Resolution **739 (Rev.WRC-1519)** applies. (WRC-1519)

Reasons: The frequency range 161.7875-161.9375 MHz is a new allocation to the maritime mobile-satellite service (space-to-Earth). To ensure protection of the RAS this frequency range has to be added to RR No. **5.208B**.

ADD

5.226A The use of the frequency band 157.1875-157.3375 MHz by the maritime mobile-satellite service (Earth-to-space) is limited to the systems which operate in accordance with Appendix **18**. (WRC-19)

Reasons: Identify a MMSS allocation uplink for the VHF Data Exchange System which is described in Recommendation ITU-R M.2092-0.

ADD

5.226B The use of the frequency band 161.7875-161.9375 MHz by the maritime mobile-satellite service (space-to-Earth) is limited to the systems which operate in accordance with Appendix **18**. Such use is subject to the application of the provisions of No. **9.14** for coordination with stations of terrestrial services. (WRC-19)

Reasons: Identify a MMSS allocation downlink for the VHF Data Exchange System which is described in Recommendation ITU-R M.2092-0. It is also clarified, in the footnote RR No. **5.226B**, that the coordination between MMSS and terrestrial services is subject to the application of the provision of RR No. **9.14**.

* This provision was previously numbered as RR No. **5.347A**. It was renumbered to preserve the sequential order.

MOD

APPENDIX 5 (REV.WRC-1519)

Identification of administrations with which coordination is to be effected or agreement sought under the provisions of Article 9

ANNEX 1

MOD

1 Coordination thresholds for sharing between MSS (space-to-Earth) and terrestrial services in the same frequency bands and between non-GSO MSS feeder links (space-to-Earth) and terrestrial services in the same frequency bands and between RDSS (space-to-Earth) and terrestrial services in the same frequency bands (WRC-1219)

MOD

1.1 Below 1 GHz*

...

1.1.4 In the band 161.7875-161.9375 MHz, coordination of a space station of the maritime mobile-satellite service (space-to-Earth) with respect to terrestrial services is required only if the power spectral and flux-density produced by this space station exceeds the following mask in dB(W/(m² · 4 kHz)) at the Earth's surface:

PFDF(theta) ((dBW/m^2*4 kHz)) = { -149 + 0.16 * theta, 0 degrees <= theta < 45 degrees; -142 + 0.53 * (theta - 45), 45 degrees <= theta < 60 degrees; -134 + 0.1 * (theta - 60), 60 degrees <= theta <= 90 degrees.

where theta is the angle of arrival of the incident wave above the horizontal plane (degrees).

Reasons: It is proposed to extend the coordination threshold defined in Annex 1 of RR Appendix 5 for the VDES using the frequency band 161.7875-161.9375 MHz by using the pfd mask defined in Recommendation ITU-R M.2092-0.

* These provisions apply only to the MSS.

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MOD

APPENDIX 18 (REV.WRC-1519)

Table of transmitting frequencies in the VHF maritime mobile band

(See Article 52)

Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From ship stations	From coast stations		Single frequency	Two frequency	
24	w), ww), x), xx)	157.200	161.800		x	x	x
1024	w), ww), x), xx), <u>AAA</u>)	157.200	<u>157.200</u>	<u>x</u> (digital only)			
2024	w), ww), x), xx), <u>BBB</u>)	<u>161.800</u>	161.800	*			
84	w), ww), x), xx)	157.225	161.825		x	x	x
1084	w), ww), x), xx), <u>AAA</u>)	157.225	<u>157.225</u>	<u>x</u> (digital only)			
2084	w), ww), x), xx), <u>BBB</u>)	<u>161.825</u>	161.825	*			
25	w), ww), x), xx)	157.250	161.850		x	x	x
1025	w), ww), x), xx), <u>AAA</u>)	157.250	<u>157.250</u>	<u>x</u> (digital only)			

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Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From ship stations	From coast stations		Single frequency	Two frequency	
2025	w), ww), x), xx), <u>BBB</u>	161.850	161.850	*			
85	w), ww), x), xx)	157.275	161.875		x	x	x
1085	w), ww), x), xx), <u>AAA</u>	157.275	157.275	x (digital only)			
2085	w), ww), x), xx), <u>BBB</u>	161.875	161.875	*			
26	w), ww), x)	157.300	161.900		x	x	x
1026	w), ww), x), <u>AAA</u>	157.300					
2026	w), ww), x), <u>BBB</u>		161.900				
86	w), ww), x)	157.325	161.925		x	x	x
1086	w), ww), x), <u>AAA</u>	157.325					
2086	w), ww), x), <u>BBB</u>		161.925				
27	z), zx)	157.350	161.950			x	x
1027	z), zz)	157.350	157.350		x		
2027 [*] <u>ASM 1</u>	z)	161.950	161.950				
87	z), zz)	157.375	157.375		x		
28	z), zx)	157.400	162.000			x	x
1028	z), zz)	157.400	157.400		x		
2028 [*] <u>ASM 2</u>	z)	162.000	162.000				
88	z), zz)	157.425	157.425		x		
AIS 1	f), l), p)	161.975	161.975				

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Channel designator	Notes	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From ship stations	From coast stations		Single frequency	Two frequency	
AIS 2	<i>f), l), p)</i>	162.025	162.025				

* ~~From 1 January 2019, channel 2027 will be designated ASM 1 and channel 2028 will be designated ASM 2.~~

...

w) In Regions 1 and 3:

~~Until 1 January 2017, the frequency bands 157.200-157.325 MHz and 161.800-161.925 MHz (corresponding to channels: 24, 84, 25, 85, 26 and 86) may be used for digitally modulated emissions, subject to coordination with affected administrations. Stations using these channels or frequency bands for digitally modulated emissions shall not cause harmful interference to, or claim protection from, other stations operating in accordance with Article 5.~~

~~From 1 January 2017, the~~The frequency bands 157.200-157.325 MHz and 161.800-161.925 MHz (corresponding to channels: 24, 84, 25, 85, 26 and 86) are identified for the utilization of the VHF Data Exchange System (VDES) described in the most recent version of Recommendation ITU-R M.2092. These frequency bands may also be used for analogue modulation described in the most recent version of Recommendation ITU-R M.1084 by an administration that wishes to do so, subject to not causing harmful interference to, or claiming protection from other stations in the maritime mobile service using digitally modulated emissions and subject to coordination with affected administrations. (WRC-~~15~~19)

wa) In Regions 1 and 3:

~~Until 1 January 2017, the frequency bands 157.025-157.175 MHz and 161.625-161.775 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23 and 83) may be used for digitally modulated emissions, subject to coordination with affected administrations. Stations using these channels or frequency bands for digitally modulated emissions shall not cause harmful interference to, or claim protection from, other stations operating in accordance with Article 5.~~

~~From 1 January 2017, the~~The frequency bands 157.025-157.100 MHz and 161.625-161.700 MHz (corresponding to channels: 80, 21, 81 and 22) are identified for utilization of the digital systems described in the most recent version of Recommendation ITU-R M.1842 using multiple 25 kHz contiguous channels.

~~From 1 January 2017, the~~The frequency bands 157.150-157.175 MHz and 161.750-161.775 MHz (corresponding to channels: 23 and 83) are identified for utilization of the digital systems described in the most recent version of Recommendation ITU-R M.1842 using two 25 kHz contiguous channels. From 1 January 2017, the frequencies 157.125 MHz and 161.725 MHz (corresponding to channel: 82) are identified for the utilization of the digital systems described in the most recent version of Recommendation ITU-R M.1842.

The frequency bands 157.025-157.175 MHz and 161.625-161.775 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23 and 83) can also be used for analogue modulation described in the most recent version of Recommendation ITU-R M.1084 by an administration that wishes to do so, subject to not claiming protection from other stations in the maritime mobile service using digitally modulated emissions and subject to coordination with affected administrations. (WRC-~~15~~19)

...

xx) ~~From 1 January 2019, the~~The channels 24, 84, 25 and 85 may be merged in order to form a unique duplex channels with a bandwidth of 100 kHz in order to operate the VDES terrestrial component described in the most recent version of Recommendation ITU-R M.2092. (WRC-~~15~~19)

...

z) ~~Until 1 January 2019, these channels may be used for possible testing of future AIS applications without causing harmful interference to, or claiming protection from, existing applications and stations operating in the fixed and mobile services.~~

~~From 1 January 2019, these~~These channels are each split into two simplex channels. The channels 2027 and 2028 designated as ASM 1 and ASM 2 are used for application specific messages (ASM) as described in the most recent version of Recommendation ITU-R M.2092. (WRC-~~15~~19)

...

zz) ~~From 1 January 2019, The~~ channels 1027, 1028, 87 and 88 are used as single-frequency analogue channels for port operation and ship movement. (WRC-~~18~~19)

AAA) The combination of the channels 1024, 1084, 1025, 1085, 1026 and 1086, which are also allocated to the maritime mobile-satellite service (Earth-to-space), shall be used for the reception of VDES messages from ships as described in the most recent version of Recommendation ITU-R M.2092. (WRC-19)

BBB) The combination of the channels 2024, 2084, 2025, 2085, 2026 and 2086, which are also allocated to the maritime mobile-satellite service (space-to-Earth), shall be used for the reception of VDES messages from satellites as described in the most recent version of Recommendation ITU-R M.2092. (WRC-19)

Reasons: The above modifications of RR Appendix 18 identify a MMSS allocation uplink and downlink for the VHF Data Exchange System which is described in Recommendation ITU-R M.2092-0. The channels are identified for the satellite downlink of the VDES.

MOD

RESOLUTION 739 (REV.WRC-~~15~~19)

Compatibility between the radio astronomy service and the active space services in certain adjacent and nearby frequency bands

The World Radiocommunication Conference ([Geneva, 2015](#)[Sharm el-Sheikh, 2019](#)),

ANNEX 1 TO RESOLUTION 739 (REV.WRC-~~15~~19)

Unwanted emission threshold levels

TABLE 1-2

epfd thresholds⁽¹⁾ for unwanted emissions from all space stations of a non-GSO satellite system at a radio astronomy station

Space service	Space service frequency band (MHz)	Radio astronomy frequency band (MHz)	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by the Bureau following the entry into force of the Final Acts of:
			epfd ⁽²⁾ (dB(W/m ²))	Reference bandwidth (MHz)	epfd ⁽²⁾ (dB(W/m ²))	Reference bandwidth (kHz)	epfd ⁽²⁾ (dB(W/m ²))	Reference bandwidth (kHz)	
MSS (space-to-Earth)	137-138	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-07
<u>MMSS (space-to-Earth)</u>	<u>161.7875-161.9375</u>	<u>150.05-153</u>	<u>-238</u>	<u>2.95</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>WRC-19</u>
MSS (space-to-Earth)	387-390	322-328.6	-240	6.6	-255	10	-228	10	WRC-07
MSS (space-to-Earth)	400.15-401	406.1-410	-242	3.9	NA	NA	NA	NA	WRC-07
MSS (space-to-Earth)	1 525-1 559	1 400-1 427	-243	27	-259	20	-229	20	WRC-07
RNSS (space-to-Earth) ⁽³⁾	1 559-1 610	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07

MSS (space-to-Earth)	1 525-1 559	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-07
MSS (space-to-Earth)	1 613.8-1 626.5	1 610.6-1 613.8	NA	NA	-258	20	-230	20	WRC-03

NA: Not applicable, measurements of this type are not made in this frequency band.

⁽¹⁾ These epfd thresholds should not be exceeded for more than 2% of time.

⁽²⁾ Integrated over the reference bandwidth with an integration time of 2 000 s.

⁽³⁾ This Resolution does not apply to current and future assignments of the radionavigation-satellite system GLONASS/GLONASS-M in the frequency band 1 559-1 610 MHz, irrespective of the date of reception of the related coordination or notification information, as appropriate. The protection of the radio astronomy service in the frequency band 1 610.6-1 613.8 MHz is ensured and will continue to be in accordance with the bilateral agreement between the Russian Federation, the notifying administration of the GLONASS/GLONASS-M system, and IUCAF, and subsequent bilateral agreements with other administrations.

Reasons: The frequency range 161.7875-161.9375 MHz is a new allocation to the maritime mobile-satellite service (space-to-Earth). To ensure protection of the RAS this frequency range has to be added to Annex 1 to Resolution **739 (Rev.WRC-15)**.

SUP

RESOLUTION 360 (REV.WRC-15)

Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication

Reasons: It is proposed to suppress Resolution **360 (Rev.WRC-15)** since it will become superfluous after the studies are completed and the identification of frequencies in order to enhance maritime radiocommunication has been made by WRC-19.

Agenda item 1.10

**(WP 5B / WP 4A, WP 4B, WP 4C, WP 5A, WP 5C, WP 5D, WP 6A, WP 7D,
(WP 3M), (WP 7B), (WP 7C))**

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);

Resolution 426 (WRC-15): Studies on spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System

5/1.10/1 Executive summary

In accordance with Resolution 426 (WRC-15), ITU-R considered spectrum needs and regulatory provisions for the introduction and the use of the global aeronautical distress and safety system (GADSS).

Two methods were developed, both of which state that no changes to Radio Regulations (RR) Article 5 are required in addition to suppression of Resolution 426 (WRC-15).

In Method A, modification to RR Article 30 and a new RR Article 34A to recognize GADSS in the RR are suggested.

In Method B, by comparison, different modifications to RR Article 30, a different new RR Article 34A, and a Resolution requiring the development of ITU-R Recommendations to list the frequency bands of the systems contributing to GADSS, and their technical characteristics and protection criteria are suggested. Method B also states that, for all GADSS functions, only frequency bands that already have been allocated on a primary basis and for safety purposes be used.

5/1.10/2 Background

The International Civil Aviation Organization (ICAO) has developed a concept of operations (ConOps) to support the future development of GADSS.

The ConOps⁷ describes in particular the following functions:

- Aircraft tracking
 - Typically uses existing technologies to assist in the timely identification and location of aircraft.
 - Provides an automated reporting function every 15 mins or less.
 - Aircraft tracking may be accomplished by multiple different systems over the duration of a flight.
- Autonomous distress tracking
 - An automated method of position reporting at intervals of one minute or less to support search and rescue (SAR), triggered by indications that an aircraft is in distress which may result in an accident.

⁷ Version 6.0. In 2017 the ICAO Air Navigation Commission agreed to use Version 6.0 to guide the further development of ICAO performance-based standards in order to support the implementation of the ConOps.

- Distress tracking aims to establish the location of a potential accident site within a six nautical mile (11.11 km) radius.
- Post-flight localization and recovery
 - A combination of both the immediate need to locate and rescue possible survivors after an air accident using emergency location beacons and other methods to an accuracy of <1 nautical mile (<1.85 km), and the timely collection of aircraft components and data that will assist in the accident investigation.
- Procedures and information management
 - The method of data collection and notification of flight tracking data to the relevant SAR, and rescue coordination centres.

The ConOps provides the guidelines for the development of ICAO performance-based standards, outlining specific technical and operational requirements that an aircraft shall meet. It does not identify specific systems proposed to contribute to GADSS. ICAO intends to use systems operating under existing allocations in accordance with the provisions of the RR, including the use of emergency position-indicating radio beacons (termed as emergency locator transmitters in ICAO) operating in the 406-406.1 MHz frequency band⁸.

5/1.10/3 Summary and analysis of the results of ITU-R studies

ICAO has concluded the GADSS requirements can be satisfied using systems operating within existing aeronautical frequency allocations or distress spectrum, (e.g. the 406-406.1 MHz frequency band) and for WRC-19 no additional spectrum allocations are required. Therefore, no changes are required to RR Article 5.

Possible changes to other portions of RR have been identified to facilitate GADSS implementation⁹.

5/1.10/3.1 Relevant ITU-R Recommendations and Reports

Working document towards a preliminary draft new Report ITU-R M.[GADSS].

5/1.10/4 Methods to satisfy the agenda item

Two methods are proposed to satisfy the agenda item and both involve suppression of Resolution 426 (WRC-15).

5/1.10/4.1 Method A

Regarding *invites ITU-R 2* of Resolution 426 (WRC-15), in order to facilitate its introduction, modification of the RR are proposed to include GADSS as a distress and safety communications system in RR Chapter VII – Distress and safety communications.

⁸ The 406-406.1 MHz frequency band is already identified for the use of emergency position-indicating radiobeacons in the provisions of RR No. 5.266.

⁹ It was noted that some RR provisions outside the scope of WRC-19 agenda item 1.10 may not reflect the current/future plans for aeronautical use. No related WRC-19 action is proposed regarding those provisions.

The modifications of RR proposed under Method A specify:

- that the details of the GADSS elements are contained in Annexes to the ICAO Convention;
- that the type of radiocommunication service used depends on the requirements of the specific GADSS function;
- that operation of GADSS elements under RR No. 4.4 is precluded.

5/1.10/4.2 Method B

Regarding *invites ITU-R 2* of Resolution **426 (WRC-15)**, in order to facilitate its introduction, modification of the RR are proposed to include GADSS as a distress and safety communications system in RR Chapter VII – Distress and safety communications. In addition, the frequency bands used for GADSS, its systems, their technical characteristics and protection criteria shall be reflected in the relevant ITU-R Recommendations. Therefore, a new Resolution [**A110-GADSS**] (**WRC-19**) calling ICAO to provide to ITU-R the information in relation to the frequency bands and systems included in GADSS and also the information about the technical characteristics of such systems and inviting ITU-R to develop appropriate Recommendations shall be developed.

The modifications of the RR proposed under Method B specify:

- that the details of the GADSS elements are contained in Annexes to the ICAO Convention;
- that GADSS shall only operate using primary service allocations;
- that the GADSS must operate in accordance with the terms of new Resolution [**A110-GADSS**] (**WRC-19**), resolving:
 - that systems composing the GADSS shall only operate in frequency bands that have already been provided for safety purposes;
 - that ITU-R shall develop ITU-R Recommendations detailing the system elements of the GADSS including their operating frequency bands and technical characteristics;
 - that if constituent elements of GADSS are changed, those changes should be reflected in the relevant ITU-R Recommendation.

5/1.10/5 Regulatory and procedural considerations

5/1.10/5.1 Method A

NOC

ARTICLE 5

Frequency allocations

CHAPTER VII

Distress and safety communications¹

ARTICLE 30

General provisions

Section I – Introduction

MOD

30.1 § 1 **Nos. 30.4-30.13, and Articles 31, 32, 33 and 34 of T**his Chapter contains the provisions for the operational use of the global maritime distress and safety system (GMDSS), whose functional requirements, system elements and equipment carriage requirements are set forth in the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended. **This Chapter** **These Nos. and Articles** also contains provisions for initiating distress, urgency and safety communications by means of radiotelephony on the frequency 156.8 MHz (VHF channel 16). (WRC-07~~19~~)

ADD

30.1A Article **34A** of this Chapter contains the provisions for the global aeronautical distress and safety system (GADSS), whose functional requirements are set forth in the Annexes to the Convention on International Civil Aviation, as amended. (WRC-19)

ADD

ARTICLE 34A

Global aeronautical distress and safety system

ADD

34A.1 The global aeronautical distress and safety system (GADSS) determines performance requirements for the radiocommunication systems utilized for conducting functions such as aircraft tracking, autonomous distress tracking, and post-flight localization and recovery. (WRC-19)

ADD

34A.2 The type of radiocommunication service(s) to be used by systems contributing to the GADSS depend(s) on the requirements of the specific GADSS function. Systems contributing to the GADSS shall not be operated under the provisions of No. **4.4**. (WRC-19)

SUP

RESOLUTION 426 (WRC-15)

Studies on spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System

5/1.10/5.2 Method B

NOC

ARTICLE 5

Frequency allocations

CHAPTER VII

Distress and safety communications¹

ARTICLE 30

General provisions

Section I – Introduction

MOD

30.1 § 1 Nos. 30.4-30.13, and Articles 31, 32, 33 and 34 of This Chapter contains the provisions for the operational use of the global maritime distress and safety system (GMDSS), whose functional requirements, system elements and equipment carriage requirements are set forth in the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended. ~~This Chapter~~ These Nos. and Articles also contains provisions for initiating distress, urgency and safety communications by means of radiotelephony on the frequency 156.8 MHz (VHF channel 16). Article 34A of this Chapter contains provisions for the global aeronautical distress and safety system (GADSS), whose functional requirements, system elements and equipment carriage requirements are set forth in the Annexes to the Convention on International Civil Aviation, as amended. (WRC-0719)

ADD

ARTICLE 34A

Global aeronautical distress and safety system

ADD

34A.1 The GADSS determines performance requirements for the radiocommunication systems utilized for conducting several functions, such as aircraft tracking, autonomous distress tracking, and post-flight localization and recovery.

Resolution [A110-GADSS] (WRC-19) is applied for operation of GADSS. (WRC-19)

ADD

34A.2 The performance requirements, system elements and equipment carriage requirements of GADSS are set forth in ICAO standards and recommended practices, guidance material and manuals. (WRC-19)

ADD

34A.3 The radiocommunication systems meeting the GADSS performance requirements may operate in the radiocommunication services having an appropriate allocation in Article 5. The choice of a primary type of radiocommunication service to be used depends on the requirements of the specific GADSS function. (WRC-19)

ADD

DRAFT NEW RESOLUTION [A110-GADSS] (WRC-19)

Implementation and operation of global aeronautical distress and safety system

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a) that the International Civil Aviation Organization (ICAO) has developed the concept of operations for the global aeronautical distress and safety system (GADSS);
- b) that GADSS is intended to provide for the timely identification and location of an aircraft during all phases of flight including distress and emergency situations, which will also support search and rescue (SAR) and flight data recorder recovery;
- c) that the GADSS at its current development phase can be introduced within existing primary aeronautical frequency allocations, and may not need any new systems or applications for such introduction;

d) that the full GADSS concept can be realized in an evolutionary manner, and some applications may be developed after 2019,

recognizing

a) that SAR operations of aircraft passengers and crew survived in an aircraft accident have the highest priority;

b) that retrieval of flight recorder data is required to prevent aircraft accidents in future;

c) that interference-free operation of systems included in GADSS and protection of the GADSS frequencies included in the Radio Regulations, should be ensured;

d) that there are provisions in the Radio Regulations, including frequency band allocations, related to aeronautical services that support distress and safety systems;

e) that Annex 10 to the Convention on International Civil Aviation is a part of international standards and recommended practices for aeronautical telecommunication systems used by international civil aviation,

resolves

1 that GADSS elements shall use frequency bands which have already been provided for safety purposes;

2 that the frequency bands used by GADSS, its system elements and their technical characteristics to be contained in ITU-R Recommendation(s) as appropriate;

3 that in case of changes of the frequency bands, system elements included in GADSS or their technical and operational characteristics, these changes to be contained in ITU-R Recommendation(s) as appropriate,

invites ITU-R

based on the information to be provided by ICAO, to develop the relevant ITU-R Recommendation(s) and to ensure their timely update,

instructs the Secretary-General

to bring this Resolution to the attention of the Secretary-General of ICAO,

invites the International Civil Aviation Organization

to provide to ITU-R the information in relation to GADSS elements, their technical and operational characteristics and operational frequency bands for development of the relevant ITU-R Recommendations and timely update this information in case of change of GADSS elements, their technical characteristics and operational frequency bands.

SUP

RESOLUTION 426 (WRC-15)

Studies on spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System

Agenda item 9.1

9.1 *to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention:*

9.1.1 *on the activities of the Radiocommunication Sector since WRC-15;*

Resolution **763 (WRC-15)** – *Stations on board sub-orbital vehicles*

Note: Nine issues have been identified by CPM19-1 under this agenda item.

Agenda item 9.1(9.1.4)

5/9.1.4 Resolution 763 (WRC-15)

Stations on board sub-orbital vehicles.

(WP 5B / WP 4A, WP 4C, WP 7B)

5/9.1.4/1 Executive summary

ITU-R is studying the impact of the future deployments of sub-orbital vehicles on radiocommunication regulations and some aspects would require further consideration. Thus, there is no identification of any change to the Radio Regulations at WRC-19.

5/9.1.4/2 Background

WRC-15 adopted Resolution **763 (WRC-15)** to consider stations on board sub-orbital vehicles. It has been resolved to conduct studies during the WRC-19 study cycle:

- to identify any required technical and operational measures, in relation to stations on board sub-orbital vehicles, that could assist in avoiding harmful interference between radiocommunication services;
- to determine spectrum requirements and, based on the outcome of those studies, to consider a possible future agenda item for WRC-23.

It is also noted that ITU-R in 2015 formulated Question ITU-R [259/5](#).

Sub-orbital vehicles, including space planes, have been developed to reach altitudes much higher than conventional aircraft. Some of them aim to reach space. Sub-orbital vehicles may perform various missions (e.g. deploying a space vehicle, conducting scientific research, carrying passengers) and then return to the Earth's surface.

Sub-orbital vehicles must safely share airspace used by conventional aircraft during certain phases of flight. There is a need to track and to be able to communicate and send commands to the sub-orbital vehicles for the entire duration of the flight. It is expected to use existing allocations, in particular, for systems and applications related to aviation safety and standardized by ICAO for harmonization and interoperability.

ICAO has begun efforts to change some existing aviation equipment standards to support possible use of that equipment by craft flying at altitudes and speeds greater than those reached by conventional aircraft.

5/9.1.4/3 Summary and analysis of the results of ITU-R studies

The ITU-R initiated regulatory, technical and operational studies on sub-orbital vehicles.

5/9.1.4/3.1 Regulatory issues

The definitions of sub-orbital vehicle and sub-orbital flight still need to be agreed taking into account that other international organizations are also dealing with this topic. Indeed, there is no internationally agreed boundary between the Earth's atmosphere and the space domain¹⁰. Consequently, there is not a defined delimitation between terrestrial services and space services as described in Article 1 of the Radio Regulations.

One view is to categorize sub-orbital vehicles in regards to their mission type. For an aeronautical usage such as transportation of passengers and cargo it may be considered that all the aeronautical services could be relevant, and used during all phases of the mission.

Another view is to consider a distinction between operations in the Earth's atmosphere and operations in space, as described in the following two sections.

5/9.1.4/3.2 Operations in the Earth's atmosphere

When operating in airspace controlled by an air navigation service provider, sub-orbital vehicles and space planes may be required to be equipped with the aeronautical systems operating under the same ICAO standards as the other aircraft operating in that airspace. Due to their high speed relative to conventional aircraft, the same equipment could be required in order to anticipate trajectories passing through portions of controlled airspace.

Sub-orbital vehicles would be expected to use the existing aeronautical allocations in accordance with the Radio Regulations. No regulatory changes are anticipated for stations on board sub-orbital vehicles operating in the Earth's atmosphere.

5/9.1.4/3.3 Operations in space

Some sub-orbital vehicles are intended to reach such altitudes and ensure space missions that define them as spacecraft within the Radio Regulations. However, some radiocommunication equipment on board sub-orbital vehicles may expect to use frequency bands that are not included in the space radiocommunication service allocation, such as the ones operated under terrestrial allocations and interoperable with ICAO standardized systems.

One view is that a sub-orbital vehicle may be regarded as a space station and therefore any radiocommunications with the sub-orbital vehicle may also be regarded as space radiocommunications in accordance with the definitions of Article 1 of the Radio Regulations. The stations on board a sub-orbital vehicle, when in space, may not be considered as an earth station, nor terrestrial station. Sub-orbital vehicles may not be allowed to use terrestrial services nor satellite services, in particular those used by international civil aviation, such as the mobile-satellite services or the aeronautical mobile (R) service. A regulatory provision then would have to be issued.

Another view is that stations on board sub-orbital vehicles may be able to communicate with mobile satellite-service satellites throughout all phases of flight and such operations are consistent with the definition of the mobile-satellite service contained in RR No. 1.25. Consideration should be given to direction of use (space-to-space, space-to-Earth, and Earth-to-space). However, in this case regulatory provisions may be necessary to be able to continue to operate terrestrial aeronautical services.

¹⁰ *Considering b*) of WRC-15 Resolution 763 (WRC-15) states that the boundary between the Earth's atmosphere and space is usually assumed to be 100 kilometres above the Earth's surface.

5/9.1.4/3.4 Technical studies including link analyses, Doppler shift, and frequency planning

Preliminary draft new Report ITU-R M.[SUBORBITAL VEHICLES] contains the studies utilized for this agenda item. Study 1 is contained in Annex 3 of the preliminary draft new Report ITU-R M.[SUBORBITAL VEHICLES], Study 2 is contained in Annex 4 of the preliminary draft new Report ITU-R M.[SUBORBITAL VEHICLES].

Study 1 contains the link budget analyses for sub-orbital vehicles using avionics systems for communications, navigation, and surveillance have been studied and show that the performance required for radiocommunications may be fulfilled when there is no radiocommunications blackout. Study 2 indicates that to avoid a communications blackout, additional communications system(s) may be required to provide continuous coverage throughout the entire mission. Indeed, during some types of re-entry, there may be a loss of radiocommunications, and certain frequencies may be more susceptible to the loss of link, while frequency bands higher than 23 GHz may help mitigate or eliminate this problem.

Study 1 also provides the Doppler shift analyses for sub-orbital vehicles using avionics systems for communications navigation and surveillance and show that the performance required for radiocommunications may be fulfilled. The same study shows there may be impact on terrestrial frequency planning but the study does not take into account such impact on other services. In Study 2, Doppler shift and rate of change were also analysed for an example mission of a sub-orbital vehicle. The Doppler effect and its rate of change due to the speed and acceleration of sub-orbital vehicles during some flight phases may have to be further analysed including the avoidance of impact on other services.

5/9.1.4/3.5 Further regulatory analysis and technical studies

Regulatory analyses may be required on how applications commonly operated under terrestrial services, in particular aeronautical mobile services, or under satellite services could also be used in space and to which radio station category this would be considered.

Consideration is needed for the definition of a sub-orbital flight and a sub-orbital vehicle.

Technical studies to assess the potential for interference between services may have to be considered in the case of a sub-orbital vehicle operated in space with:

- stations commonly operated under terrestrial services;
- stations commonly operated under satellite services.

Existing relevant Recommendations and Reports are listed as follows:

- i) Working document towards a preliminary draft new Report ITU-R M.[SUBORBITAL VEHICLES] - Radiocommunications for sub-orbital vehicles

5/9.1.4/4 Conclusions

No change to the Radio Regulations is proposed for WRC-19. Further operational, technical and regulatory issues may need to be addressed, which require continuing studies, in particular of the status of the station aboard sub-orbital vehicles and type of applications, through the appropriate mechanism. No action has been taken with respect to retention, revision or suppression of Resolution 763 (WRC-15).