

ATTACHMENT A
to FCC Public Notice DA 19-172

Draft Proposals presented at
March 11th, 2019 Meeting of the
World Radiocommunication Conference Advisory Committee

Maritime Aeronautical and Radar Services

Document WAC/077 (11.03.19)

UNITED STATES OF AMERICA

WRC-19 Agenda Item 1.8

Issue A – Modernization of GMDSS

Agenda Item 1.8 *to consider possible regulatory actions to support Global Maritime Distress Safety Systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS, in accordance with Resolution 359 (Rev.WRC-15);*

Introduction

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 Resolution, GMDSS modernization is referred to as “Issue A” and is addressed in this proposal. 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” but is addressed separately.

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.

The International Maritime Organization (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 analog services is declining while other new digital technologies are being introduced such as VHF data exchange system (VDES) and the NAVDAT system. The terrestrial component of VDES was previously addressed by WRC-15 and WRC-19 will consider the satellite component of VDES separately under agenda item 1.9.2.

The use of navigational text (NAVTEX) was incorporated into the regulations for the GMDSS under Chapter V of the SOLAS regulations for disseminating maritime safety information. The ITU-R performed studies which resulted in the adoption of 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*” and 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*”. NAVDAT is considered as an enhancement of existing NAVTEX and could be considered as a potential replacement of NAVTEX as part of the continued modernization of the GMDSS.

Taking into account the studies performed during this study period under the resolves 1 of Resolution 359 (Rev.WRC-15) and noting the information and requirements provided by IMO, in order to determine the regulatory provisions to support GMDSS modernization, this proposal contains some regulatory provisions to facilitate the introduction of NAVDAT and progress the modernization of the GMDSS which will be further addressed at WRC-23 under Resolution 361 (Rev.WRC-15).

Proposal

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD USA/1.8A/1

5.79 The use of the allocations to the maritime mobile service in the frequency bands 415-495 kHz and 505-526.5 kHz (505-510 kHz in Region 2 is limited to radiotelegraphy. These bands may also be used for the NAVDAT system as described in the most recent version of Recommendation ITU-R M.2010. (rev WRC-19)

Reasons: These two bands are used currently by the NAVTEX system. This new NAVDAT addition will complement the current NAVTEX system capabilities as described in Recommendation ITU-R M.2010.

MOD USA/1.8A/2

495-1 800 kHz

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

ADD USA/1.8A/3

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

Reasons: This new footnote secure the usage of this frequency bands solely for the NAVDAT system.

MOD USA/1.8A/4

APPENDIX 17 (REV.WRC-19)

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

(See Article 52)

Reasons: These notes have been overcome by events are no longer needed.

SUP USA/1.8A/5

ANNEX 1* (WRC-15)

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

Reasons: Annex 1 of Appendix 17 was only in force until 31 December 2016, therefore it is no longer needed.

MOD USA/1.8A/6

Frequency and channelling arrangements in the high-frequency bands for the maritime mobile service, which enter into force on 1 January 2017 (WRC-12)

Reasons: Annex 2 title header is no longer needed since Annex 1 has been suppressed.

MOD EUR/1.8A/7

PART A – Table of subdivided bands (WRC-19)

In the Table, where appropriate¹, the assignable frequencies in a given band for each usage are:

- indicated by the lowest and highest frequency, in heavy type, assigned in that band;
- regularly spaced, the number of assignable frequencies (*f*.) and the spacing in kHz being indicated in italics.

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

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

¹ Within the non-shaded boxes.

pp) These sub-bands are also designated for digitally modulated emissions in the maritime mobile service for the transmission of NAVDAT type information as described in the most recent version of Recommendation ITU-R M.2058.

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Reasons: Identification in the RR Appendix **17** of the frequencies which could be used for the NAVDAT system in HF. Those frequencies are described in Recommendation ITU-R M.2058.

SUP **USA/1.8A/8**

RESOLUTION 359 (REV.WRC-15)

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

Reasons: This Resolution is proposed to be suppressed considering the finalization of the studies on WRC-19 Agenda item 1.8 covered by the resolves 1(modernization of the GMDSS). Any further action regarding the modernization of the GMDSS will be covered by the Resolution **361 (WRC-15)** for WRC-23. The parts of this resolution that are relevant to WRC-19 Agenda item 1.8 covered by the resolves 2 are considered in the appropriate European Proposals submitted to this conference.

UNITED STATES OF AMERICA
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 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);*

Background

The purpose of this agenda item is to consider recognition of autonomous maritime radio devices (AMRD) that can enhance safety of navigation while ensuring that these AMRDs do not harm the integrity of the global maritime distress and safety system (GMDSS) and the automatic identification system (AIS).

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).

AMRD Group A are devices that enhance the safety of navigation may be subject to IMO SOLAS regulations for the presentation of information to the navigators on board vessels. Other AMRD may be considered as Group B AMRD depending on certain characteristics and parameters.

The technical characteristics of AMRD are provided in Recommendation ITU-R M.[AMRD] “[Technical characteristics of Autonomous Maritime Radio Devices in the frequency bands 156-162.05 MHz]”. This Recommendation describes AMRD as follows:

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).

Group A, AMRD that enhance the safety of navigation, should use the frequencies of the current RR Appendix 18 for digital selective calling (channel 70), the channel for distress, safety and calling (channel 16), the AIS channels (channels AIS 1 and AIS 2).

Group B, AMRD that do not enhance the safety of navigation, but also operating in the maritime environment should only use a channel 2006 of Appendix 18.

Proposals

MOD USA/1.9.1/1

APPENDIX 18 (REV.WRC-19)

**Table of transmitting frequencies in the
VHF maritime mobile band**

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Specific notes

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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 and/or AIS-technology as described in the most recent version of Recommendation ITU R M.[AMRD]. (WRC-19)

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r) In the maritime mobile service, this frequency is reserved for usage of autonomous maritime radio devices Group B using AIS-technology as described in the most recent version of Recommendation ITU-R M.[AMRD]. This frequency may also be used for future AIS-technology based applications or systems on an experimental basis. If authorized by administrations for AIS-technology based autonomous maritime radio devices Group B or experimental AIS-technology applications, their operation shall not cause harmful interference to, or claim protection from, stations operating in the fixed and mobile services. (WRC-19)

Reasons: These modifications to Appendix 18 allow the operation of AMRD AIS-technology based Group A, devices which have been identified to enhance the maritime safety of navigation; and AMRD Group B device that do not enhance maritime safety of navigation but operate in the maritime environment.

SUP USA/1.9.1/2

RESOLUTION 362 (REV.WRC-15)

**Autonomous maritime radio devices operating in
the frequency band 156-162.05 MHz**

Reasons: It is proposed to suppress Resolution 362 (WRC-15) since the studies have been completed and the identification of frequencies in Appendix 18 for AMRD has been made by WRC-19.

**UNITED STATES OF AMERICA
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE**

Agenda Item 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);*

BACKGROUND

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 radiocommunications*”, invites ITU-R to conduct, as a matter of urgency, and in time for WRC-19, sharing and compatibility studies between VDES satellite components and incumbent services in the same and adjacent frequency bands specified in *recognizing d) and e)* to determine potential regulatory actions, including spectrum allocations to the MMSS (Earth-to-space and space-to-Earth) for VDES applications. To this end, the ITU-R has initiated sharing studies between the proposed VDES satellite (VDE-SAT) frequencies and the incumbent services in the same and adjacent bands so that this component does 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). The satellite component of the VDES could be beneficial towards enhancing maritime navigation and safety related applications on a global basis.

Under **5.225A**, the adjacent frequency band 154-156 MHz includes a primary allocation to the radiolocation service in some countries.

Studies within ITU-R Working party 5B (WP 5B) concluded that compatibility between the radiolocation service and the maritime mobile satellite service (Earth-to-space) is feasible without imposing any additional constraints on the radiolocation service. Application of the radiolocation service in the frequency band 154-156 MHz is limited to the space surveillance radars.

Furthermore, WP5B completed a report, now published, Report ITU-R M.2435-2018 “Technical studies on the satellite component of the VHF data exchange system”, on the technical characteristics and feasibility assessment of the VDES satellite component.

10. EXECUTIVE SUMMARY

In accordance with Resolution **360 (Rev.WRC-15)**, the ITU-R has undertaken studies for possible new allocations 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 RR Appendix **18**, to support the digital evolution of maritime radio communications.

The results of the sharing and compatibility studies are contained in Recommendation ITU-R M.2092-0 which was developed in the WRC-15 study cycle, and Report ITU-R M.2435-0, which has been developed in this study cycle.

Based on the results of these studies, six methods have been developed to satisfy WRC-19 agenda item 1.9.2. The main differences between the methods are the frequency plan and pfd-mask to be imposed on the MMSS (space-to-Earth) emissions, which are further described in Report ITU-R M.2435-0.

THIS PROPOSAL

This proposal entails new primary allocations to the maritime mobile-satellite service (MMSS) (Earth-to-space) and (space-to-Earth), based on alternative frequency plan 2, with provisions for the optional use of the Appendix 18 duplex channels in simplex mode (in accordance with alternative frequency plan 3), as described in Report ITU-R M.2435-0. The coordination mechanism with respect to terrestrial services under RR No. **9.14** is proposed, with the pdf mask, for the satellite downlink.

REGULATORY PROCEDURES

ARTICLE 5 Frequency Allocations

Section IV – Frequency Allocation Table (See number 2.1)

MOD

148-161.9375 MHz

Allocation to services		
Region 1	Region 2	Region 3
156.8375-157.1875 FIXED MOBILE except aeronautical mobile 5.226	156.8375-157.1875 FIXED MOBILE 5.226	
157.1875-157.3375 FIXED MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (Earth-to-space) MOD 5.228AA 5.226	157.1875-157.3375 FIXED MOBILE MARITIME MOBILE-SATELLITE (Earth-to-space) MOD 5.228AA 5.226	
157.3375-160.9625 FIXED MOBILE except aeronautical mobile 5.226	157.3375-160.9625 FIXED MOBILE 5.226	
160.9625- 161.4875 FIXED MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (space-to-Earth) MOD 5.208A MOD 5.208B ADD 5.A192 5.226	160.9625-161.4875 FIXED MOBILE MARITIME MOBILE-SATELLITE (space-to-Earth) MOD 5.208A MOD 5.208B ADD 5.A192 5.226	
161.4875-161.7875 FIXED MOBILE except aeronautical mobile 5.226	161.4875-161.7875 FIXED MOBILE 5.226	
161.7875-161.9375 FIXED MOBILE except aeronautical mobile MARITIME MOBILE-SATELLITE (Earth-to-space) MOD 5.228AA 5.226	161.7875-161.9375 FIXED MOBILE MARITIME MOBILE-SATELLITE (Earth-to-space) MOD 5.228AA 5.226	

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5.228AA The use of the frequency bands 157.1875-157.3375 MHz, 161.7875-161.9375 MHz, 161.9375-161.9625 MHz and 161.9875-162.0125 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.A192 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 satellite systems operating in accordance with the most recent version of Recommendation ITU-R M.2092. Such use is subject to the application of the provisions of No. **9.14**. (WRC-19)

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5.208A In making assignments to space stations in the mobile-satellite service in the bands 137-138 MHz, 387-390 MHz, 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 as shown in the relevant ITU-R Recommendation. (WRC-19)

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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-19)** applies. (WRC-19)

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

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APPENDIX 18 (REV.WRC-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), x), xx)	157.200	161.800		x	x	x
1024	w), x), xx), AAA)	157.200					
2024	w), x), xx), AAA)	161.800	161.800	x (digital only)			
84	w), x), xx)	157.225	161.825		x	x	x
1084	w), x), xx), AAA)	157.225					
2084	w), ww), x), xx), AAA)	161.825	161.825	x (digital only)			
25	w), x), xx)	157.250	161.850		x	x	x
1025	w), ww), x), xx), AAA)	157.250					
2025	w), x), xx), AAA)	161.850	161.850	x (digital only)			
85	w), x), xx)	157.275	161.875		x	x	x
1085	w), x), xx), AAA)	157.275					
2085	w), x), xx), AAA)	161.875	161.875	x (digital only)			
26	w), x)	157.300	161.900		x	x	x
1026	w), x), AAA)	157.300					
2026	w), x), AAA)		161.900				
86	w), x)	157.325	161.925		x	x	x
1086	w), x), AAA)	157.325					
2086	w), x), AAA)		161.925				
27	z)	157.350	161.950			x	x
1027	zz)	157.350	157.350		x		
2027*	z)	161.950	161.950				
87	zz)	157.375	157.375		x		
28	z)	157.400	162.000			x	x
1028	zz)	157.400	157.400		x		
2028*	z)	162.000	162.000				

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	
88	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

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Specific notes

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The frequency bands 157.1875-157.3375 MHz and 161.7875-161.9375 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-19)

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The frequency bands 157.0125-157.1125 MHz and 161.6125-161.7125 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.

The frequency bands 157.1375-157.1875 MHz and 161.7375-161.7875 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. 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 157.0125-157.1875 MHz and 161.6125-161.7875 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-19)

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x) In Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Democratic Republic of the Congo, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe, the frequency bands 157.1125-157.3375 and 161.7125-161.9375 MHz (corresponding to channels: 82, 23, 83, 24, 84, 25, 85, 26 and 86) are designated for digitally modulated emissions. In China, the frequency bands 157.1375-157.3375 and 161.7375-161.9375 MHz (corresponding to channels: 23, 83, 24, 84, 25, 85, 26 and 86) are designated for digitally modulated emissions. (WRC-19)

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

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- z) The channels 27 and 28 are each split into two simplex channels. The channels 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-19)

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

ADD

AAA) These channels shall be used for the maritime mobile-satellite service (Earth-to-space) by the VDES satellite component (VDE-SAT) 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 identified for ship-to-shore, shore-to-ship and ship-to-ship communications, but ship-to-satellite (VDE-SAT uplink) communications may be possible without imposing constraints on ship-to-shore communications.
- The channels 2024, 2084, 2025 and 2085 are identified for shore-to-ship and ship-to-ship communications, but ship-to-satellite (VDE-SAT uplink) communications may be possible without imposing constraints on shore-to-ship and ship-to-ship communications.
- The channels 1026, 1086, 2026 and 2086 are identified for ship-to-satellite (VDE-SAT uplink) communications and are not used by the terrestrial component of VDES. (WRC-19)

Reasons: Notes *a) to l), n) to v) and y)*: No change as the notes are not relevant to this agenda item
Notes *w), wa), ww), x), xx), z), zx) and zz)*: Changes are to update the Radio Regulations and correction on the frequency bands.

Note *AAA)*: Introduces the satellite component of VDES (VDE-SAT) into Appendix **18** on both lower leg and upper leg of channels 24, 84, 25, 85, 26 and 86 for ship-to-satellite (VDE-SAT uplink) according to the most recent version of the Recommendation ITU-R M.2092

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RESOLUTION 739 (REV.WRC-19)

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

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

ANNEX 1 TO RESOLUTION 739 (REV.WRC-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 band (MHz)	Radio astronomy 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
MMSS (space-to-Earth)	160.9625-161.4875	150.05-153	-238	2.95	NA	NA	NA	NA	WRC-19
MMSS (space-to-Earth)	160.9625-161.4875	322-328.6	-240	6.6	-255	10	-228	10	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: Resolution **360 (WRC-15)** is proposed to be suppressed as it will not be needed when the regulatory provisions and spectrum allocations to the maritime mobile-satellite service required to enable the VDES satellite component (VDE-SAT) have been approved by WRC-19.

MOD

APPENDIX 5 (REV.WRC-19)

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

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TABLE 5-1 (continued) (Rev. WRC-19)

Reference of Article 9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. 9.14 Non-GSO/ terrestrial, GSO/ terrestrial	A space station in a satellite network in the frequency bands for which a footnote refers to No. 9.11A or to No. 9.14, in respect of stations of terrestrial services where threshold(s) is (are) exceeded	1) Frequency bands for which a footnote refers to No. 9.11A; or 2) 11.7-12.2 GHz (Region 2 GSO FSS) 3) 5 030-5 091 MHz 4) 160.9625-161.4875 MHz (non-GSO maritime mobile-satellite service)	1) See § 1 of Annex 1 to this Appendix; In the bands specified in No. 5.414A, the detailed conditions for the application of No. 9.14 are provided in No. 5.414A for MSS networks or 2) In the band 11.7-12.2 GHz (Region 2 GSO FSS): -124 dB(W/(m ² · MHz)) for 0° ≤ θ ≤ 5° -124 + 0.5 (θ - 5) dB(W/(m ² · MHz)) for 5° < θ ≤ 25° -114 dB(W/(m ² · MHz)) for θ > 25° where θ is the angle of arrival of the incident wave above the horizontal plane (degrees) 3) Bandwidth overlap 4) In the band 160.9625-161.4875 MHz (non-GSO maritime mobile-satellite service): -141.72 - 8.15 + 12*(θ°/16.47) ² dB(W/(m ² · 4 kHz)) for 0° ≤ θ < 8.5° -149 + 0.16·θ° dB(W/(m ² · 4 kHz)) for 8.5° ≤ θ < 45° -142 + 0.53·(θ° - 45°) dB(W/(m ² · 4 kHz)) for 45° ≤ θ < 58.5° -141.72 + 6.85 - 10log ₁₀ ((θ°/16.47) ^{-1.5} + 0.7) dB(W/(m ² · 4 kHz)) for 58.5° ≤ θ ≤ 90° where θ is the angle of arrival of the incident wave above the horizontal plane (degrees).	1) See § 1 of Annex 1 to this Appendix	

Reasons: The above modification defines a coordination threshold in Table 5-1 for references of RR No. 9.14 for the VDE-SAT downlink to ensure compatibility with terrestrial services. The coordination threshold mask is defined in Annex 2 of Report ITU-R M.2435-0.

United States of America

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 10

Agenda Item 10 to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, in accordance with Article 7 of the Convention.

Background

WRC-15 adopted Resolution **763 (WRC 15)** to deal with stations on board suborbital vehicles. It was resolved to conduct studies during the WRC-19 study cycle:

- to identify any required technical and operational measures, in relation to stations on-board suborbital 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.

Further, in 2015 that the ITU-R formulated Question ITU-R 259/5, "Operational and radio regulatory aspects for planes operating in the upper level of the atmosphere." Studies in the framework of that Question are related to Resolution **763 (WRC-15)**. In particular, decides 3 of the Question asks, "What radio links will be required to support space planes' operations and under what radiocommunication service definition will they fall?"

There are planned developments for sub-orbital flight based on various types of technologies and vehicles. The approaches vary between those using a single vehicle and those that use a launch vehicle that carries the spacecraft up to an intermediate height before releasing the spacecraft to accelerate away and into a suborbital spaceflight.

The ITU-R performed technical and operational analyses of stations on-board suborbital vehicles including:

- an evaluation of the regulatory provisions that may require additions or modifications; and
- identification of the potential need for spectrum to support communications and surveillance in space, without changing the existing use of the space operations service.

In addition, the analyses examined link budgets and Doppler shift for suborbital vehicles using existing ICAO standardized radiocommunication systems and technologies. The studies concluded, while no new spectrum allocations are necessary, a WRC-23 agenda item is necessary to modify definitions to ease introducing sub-orbital vehicles communications

Proposals

ADD TBD/XXX/1

DRAFT NEW RESOLUTION [XXX] (WRC-19)

Agenda for the 2023 World Radiocommunication Conference

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

...

X.X1 to consider, in accordance with Resolution [YYY] (WRC-19), regulatory provisions to facilitate communications to sub-orbital vehicles.

Reasons: To allow revisions to the Radio Regulations, to provide regulations for communications to sub-orbital vehicles and to facilitate the safe integration of sub-orbital vehicles into the existing air traffic management system.

ADD TBD/XXX/2

DRAFT NEW RESOLUTION [YYY] (WRC-19)

Radiocommunications for Sub-Orbital Vehicles

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

considering

- a) that there are aircraft being developed to operate from the ground to an altitude considered to be outer space and return to earth within one earth rotation;
- b) that there is a need to ensure equipment installed on such aircraft can communicate safely with air traffic management systems without causing harmful interference to radiocommunication used for safety purposes on other vehicles;
- c) that the ITU has been referring to these aircraft as “sub-orbital vehicles,” but such use of aircraft are not defined in the radio regulations; that there is no internationally agreed boundary between the Earth’s atmosphere and the space domain.;
- d) that radiocommunication between sub-orbital vehicles and air traffic management are required throughout the entire flight;

e) that vehicles flying at the boundary of space and the atmosphere or re-entering the atmosphere may generate a plasma sheath that may envelop all or most of the vehicle;

f) that the plasma sheath attenuation does not allow for radiocommunications directly to the ground to pass through;

recognizing

a) that Annex 10 to the Convention on International Civil Aviation contains SARPs for aeronautical radionavigation and radiocommunication systems used by international civil aviation;

b) that suborbital vehicles will use both space and terrestrial stations;

c) that suborbital vehicles can communicate with space and terrestrial stations under existing space and terrestrial service allocations;

noting

a) that the development of compatibility criteria between ICAO-standardized aeronautical systems is the responsibility of ICAO,

resolves to invite the 2023 World Radiocommunication Conference

to consider the results of studies in accordance with Resolution [YYY], and take appropriate regulatory actions taking into account the results of ITU-R studies,

invites ITU-R

to conduct studies on and identify, in time for WRC-23, any revisions to the Radio Regulations but excluding any changes to ITU Radio Regulation Article 5 – Frequency Allocations or imposing undue constraints on other services to facilitate radiocommunications for the safe operation of sub-orbital vehicles. Those studies should be conducted in close coordination with the International Civil Aviation Organization and may include defining a sub-orbital vehicle, or sub-orbital vehicle station class, while considering appropriate radiocommunication services for flight safety applications related to interoperability with international civil aviation;

invites administrations

to participate actively in the studies by submitting contributions to ITU-R,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

Reasons: A resolution will support the ITU-R studies needed under the relevant WRC-23 agenda item.

ATTACHMENT

PROPOSAL FOR FUTURE AGENDA ITEM FOR WRC-23

Subject: Proposed Future WRC Agenda Item for WRC-2023 to consider the results of studies to facilitate communications for the safe operation of sub-orbital vehicles.

Origin: United States of America

Proposal: to identify any revisions to the Radio Regulations, but excluding any new frequency allocations, that would allow communications for the safe operation of sub-orbital vehicles under Resolution [YYY] (WRC-19);

Background/reason:

To provide a means for recognizing in the Radio Regulations communications to and from sub-orbital vehicles within existing frequency allocations.

Radiocommunication services concerned:

Aeronautical Mobile (Route) service, Aeronautical Mobile Satellite (Route) Service, Mobile Satellite Service.

Indication of possible difficulties: None foreseen

Previous/ongoing studies on the issue: Studies have been ongoing in Working Party 5B under WRC-19 agenda item 9.1 Issue 4 in the 2016-2019 Study Cycle, and since 2015 under Question ITU-R 259/5.

<i>Studies to be carried out by:</i> ITU-R Study Group 5
--

<i>with the participation of:</i> SGs 5,4 and 7

ITU-R Study Groups concerned: SG 5, SG4, and SG 7

ITU resource implications, including financial implications (refer to CV126): Minimal

Common regional proposal: Yes/No
Number of countries:

Multicountry proposal: Yes/No

Remarks

Terrestrial Services

Document WAC/082 (11.03.19)

WRC-19 Agenda Item 1.13

(43.5-47.2 GHz)

IWG-2 members were not able to reach consensus on a proposal for WRC-19 Agenda Item 1.13 regarding the identification of frequency bands for the future development of International Mobile Telecommunications (IMT), in accordance with Resolution 238 (WRC-15) for the frequency range 43.5 - 47.2 GHz. The views on the appropriate regulatory changes the FCC should support are provided.

View A is supported by: AT&T, CTIA, Ericsson, GSMA, Intel, Nokia, Samsung, Sprint, T-Mobile, Verizon

View B is supported by: GPSIA, ARRL, SES Americom, Inc, Lockheed Martin

VIEW A

UNITED STATES OF AMERICA

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1.13: *to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC-15)*

Background information: Large amounts of spectrum will be needed for IMT services to support the growth in IMT-2020 services in future. Therefore, serious consideration should be given to all bands under study for Agenda item 1.13 to accommodate such growth. Any IMT identification in a given band does not preclude the use of that frequency band by other services to which they are allocated, while at the same time providing flexibility to the national regulators to select parts of a given band for IMT use, taking into account their needs for new services as well those of the incumbents.

The frequency range 45.5-47 GHz, or parts thereof, is allocated to the Mobile Service (MS), Mobile Satellite Service (MSS), Radionavigation Service (RNS), and Radionavigation Satellite Service (RNSS). The 47-47.2 GHz frequency band is allocated to the Amateur and Amateur Satellite Services. The focus of the studies within ITU-R for Agenda Item 1.13 was on bands below 45 GHz due to significant interest in the 26 GHz and 40 GHz bands. With regards to sharing with MSS in both uplink and downlink directions in the 45.5-47 GHz frequency range, studies submitted to the CPM-19-2 show that large margins exist for the protection of MSS. Specifically, the sharing studies indicate that for MSS uplink, there is a large positive margin between aggregate interference from IMT and any MSS protection criteria. For MSS downlink, separation distances are small, and protection of MSS earth stations can be addressed on a national / case-by-case basis. Characteristics were not provided to TG 5/1 for RNS and RNSS in this band so no studies were performed. With regards to the band 47-47.2 GHz, any use by IMT would take into account the use under these existing allocations noting that very short propagation distance are involved at these frequencies. Further, ARS and ARRS services are able to coexist in other millimeter Wave bands with much higher power use than that by IMT systems such as by Industrial Scientific and Medical (ISM) applications in the 24-24.05 GHz and Radiolocation Services in the 77.5-78 GHz band than that by the IMT systems.

Finally, there is no need for a WRC Resolution specifying technical and operational constraints on IMT to be associated with this proposed identification for IMT. Operational characteristics that are used by cellular providers, such as base station downtilt, that change on time scales needed to minimize intra-

and inter-cell interference and also guarantee quality of service should not be encoded in the Radio Regulations.

Proposal:

ARTICLE 5

Frequency allocations

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

MOD USA/1.13/1

40-47.5 GHz

Allocation to services		
Region 1	Region 2	Region 3
43.5-47	MOBILE 5.553 ADD 5.113 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE 5.554	
47-47.2	AMATEUR AMATEUR-SATELLITE MOBILE except aeronautical mobile ADD 5.113	

Reasons: As studies show sharing with other services is feasible, these modifications provide an identification for IMT in the frequency range 45.5 to 47.2 GHz. This facilitates harmonized worldwide bands for IMT, which are highly desirable in order to achieve global roaming and the benefits of economies of scale.

ADD USA/1.13/2

- **5.113** The frequency range 45.5-47.2 GHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-19)

Reasons: Harmonized worldwide bands for IMT enable global roaming and the benefits of economies of scale as the same user equipment can be used to serve the global market.

VIEW B

VIEW B:

WAC members GPS Innovation Alliance, the American Radio Relay League, SES Americom, Inc., and Lockheed Martin Corporation endorse the NTIA proposal for No Change to the Table of Allocations under Agenda Item 1.13 for the 45.5-47 GHz and 47-47.2 GHz bands.

During the course of studies in the ITU-R between 2015 and 2018 under Agenda Item 1.13 in Task Group 5/1, there were no sharing and compatibility studies performed between IMT-2020 systems and the relevant incumbent services in the 45.5-47 GHz and 47-47.2 GHz bands. In each band, there are a number of incumbent services for which sharing and compatibility studies were required under Resolution 238 (WRC-15).

In the absence of studies conducted in the ITU-R, the only sustainable conclusion is that it has not been demonstrated that the incumbent services in either band – the mobile-satellite service, the radionavigation service, and the radionavigation-satellite service in the 45.5-47 GHz band, and the amateur and amateur-satellite services in the 47-47.2 GHz band – can be protected, as required by Resolution **238 (WRC-15)**.

In this regard, the View A proposal to identify mobile spectrum in the 45.5-47 GHz band for the terrestrial component of IMT, and to allocate spectrum in the 47-47.2 GHz band to the mobile service and identify the same for the terrestrial component of IMT, is fatally flawed. The absence of studies in the responsible ITU-R task group leaves the proposals unsubstantiated and incapable of adoption.

In addition, there is no proposal to establish by resolution the technical conditions (e.g., power limits, beam downtilt, and more) under which the terrestrial component of IMT would be operated. Without these conditions, there can be no compatibility assurance for the long term.

In the end, the View B proponents urge the Commission to accept the proposals of NTIA in Doc. WAC/084 for no change (NOC) to the Table of Allocations in the 45.5-47 GHz and 47-47.2 GHz bands.

United States of America

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.13

1.13 *to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC-15);*

Background Information: Resolution 238 (WRC-15) invites ITU-R to conduct and complete in time for WRC-19 appropriate studies to determine the spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz, as well as sharing and compatibility studies, taking into account the protection of services to which the frequency band is allocated on a primary basis, for the frequency bands:

- 24.25-27.5 GHz¹, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz, which have allocations to the mobile service on a primary basis; and
- 31.8-33.4 GHz, 40.5-42.5 GHz and 47-47.2 GHz, which may require additional allocations to the mobile service on a primary basis.

The Resolution further invites WRC-19 to consider, based on the results of these studies, additional spectrum allocations to the mobile service on a primary basis and identification of frequency bands for the terrestrial component of IMT. The bands to be considered are limited to part or all of the bands listed above.

No studies were performed in the ITU-R during the study cycle leading up to WRC-19 between IMT-2020 systems and the relevant incumbent services in the 45.5-47 GHz and 47-47.2 GHz bands. In each band, there are a number of incumbent services for which sharing and compatibility studies were required under Resolution 238 (WRC-15).

In the absence of studies, there is no basis for any determination by WRC-19 that the frequency band 45.5-47 GHz, which is allocated on a primary basis to the mobile-satellite service, the radionavigation service, and the radionavigation-satellite service (in addition to the mobile service), can be identified for the terrestrial component of IMT. In addition, in the absence of studies, there is no basis for any determination by WRC-19 that the frequency band 47-47.2 GHz, which is allocated on a primary basis to the amateur and amateur-satellite services, can be allocated to the mobile service and identified for the terrestrial component of IMT.

Proposals:

¹ “When conducting studies in the frequency band 24.5-27.5 GHz, to take into account the need to ensure the protection of existing earth stations and the deployment of future receiving earth stations under the EESS (space-to-Earth) and SRS (space-to-Earth) allocation in the frequency band 25.5-27 GHz.”

ARTICLE 5

Frequency allocations

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

NOC USA/A13/1

40-47.5 GHz

Allocation to services		
Region 1	Region 2	Region 3
43.5-47	MOBILE 5.553 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE 5.554	
47-47.2	AMATEUR AMATEUR-SATELLITE	

Reasons: No studies were performed between IMT-2020 systems in the 45.5-47 GHz band or the 47-47.2 GHz band and the incumbent services; therefore, it has not been demonstrated that the incumbent services can be protected, as required by Resolution **238 (WRC-15)**.

SUP USA/A13/2

RESOLUTION 238 (WRC-15)

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

The World Radiocommunication Conference (Geneva, 2015),

Reasons: The studies called for under the agenda item for most of the bands have been completed. The fact that no studies on the 45.5-47 GHz band or the 47-47.2 GHz band, which were called for under the agenda item, have been performed indicates no interest in these bands for IMT-2020. There is no need to retain Resolution **238 (WRC-15)**.

Document WAC/083 (11.03.19)

**WRC-19 Agenda Item 1.13
(50.4 – 52.6 GHz)**

IWG-2 members were not able to reach consensus on a proposal for WRC-19 Agenda Item 1.13 regarding the identification of frequency bands for the future development of International Mobile Telecommunications (IMT), in accordance with Resolution 238 (WRC-15) for the frequency range 50.4 – 52.6 GHz. The views on the appropriate regulatory changes the FCC should support are provided.

View A is supported by: AT&T, CTIA, Ericsson, GSMA, Intel, Nokia, Samsung, Sprint, T-Mobile, Verizon

View B is supported by: Echostar Corporation, Lockheed Martin, SES Americom, Inc., WorldVu Satellites Ltd. d/b/a OneWeb

VIEW A

UNITED STATES OF AMERICA

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

1.13 *to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC-15);*

Background:

Mobile broadband plays an increasingly crucial role in providing access to businesses and consumers worldwide. According to International Telecommunications Union (ITU) statistics, “Mobile-broadband subscriptions have grown more than 20% annually in the last five years and are expected to reach 4.3 billion globally by end 2017.” while “Mobile-broadband prices as a percentage of GNI per capita halved between 2013 and 2016 worldwide.² Incredible technological innovation has enabled the use of higher frequency bands (e.g. mmWave) to help meet the ever-increasing demand for mobile broadband. It is important to note that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple-input and multiple-output (MIMO) and beam-forming techniques in supporting enhanced mobile broadband.

The frequency range 50.4-52.6 GHz, or parts thereof, is allocated to the Fixed Service (FS), Fixed Satellite Service (FSS) and Mobile Service (MS). The frequency bands adjacent to this frequency range are allocated to the Earth Exploration Satellite Service (EESS) (passive) and Space Research Service (SRS) (passive). The results of studies between IMT-2020 and FSS showed that sharing was feasible with a large margin. Studies between IMT-2020 and FSS in these frequencies under agenda item 9.1/Issue 9.1.9 showed even better results; CPM text for Issue 9.1.9 states “separation distances between FSS earth stations and IMT base station and IMT user equipment are 260 and 330 metres, respectively. These values may be further reduced by consideration of propagation losses other than free space, the pointing of the IMT-2020 antennas in directions other than that of the FSS earth station, and the high likelihood that the antenna pattern of the FSS earth station is more directive than the 29-25 log θ pattern assumed in the analysis.”

With respect to the EESS (passive), Radio Regulations No. 5.340.1 applies.

5.340.1 The allocation to the Earth exploration-satellite service (passive) and the space research service (passive) in the band 50.2-50.4 GHz should not impose undue constraints on the use of the adjacent bands by the primary allocated services in those bands.

² ICT Facts and Figures 2017, p 4 and 5. See: <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf>

Finally, there is no need for a WRC Resolution specifying technical and operational constraints on IMT to be associated with this proposed identification for IMT. Operational characteristics that are used by cellular providers, such as base station downtilt, that change on time scales needed to minimize intra- and inter-cell interference and also guarantee quality of service should not be encoded in the Radio Regulations.

Proposal:

ARTICLE 5

Frequency allocations

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

MOD USA/1.13/1

47.5-51.4 GHz

Allocation to services		
Region 1	Region 2	Region 3
50.4-51.4	FIXED FIXED-SATELLITE (Earth-to-space) 5.338A MOBILE ADD 5.A1113 Mobile-satellite (Earth-to-space)	

Reasons: Taking into account No. 5.340.1, sharing is feasible between IMT-2020 and other services in 50.4-51.4 GHz. This facilitates harmonized worldwide bands for IMT, which are highly desirable in order to achieve global roaming and the benefits of economies of scale.

MOD USA/1.13/2

51.4-55.78 GHz

Allocation to services		
Region 1	Region 2	Region 3
51.4-52.6	FIXED 5.338A MOBILE ADD 5.A1113 5.547 5.556	

Reasons: Taking into account No. 5.340.1, sharing is feasible between IMT-2020 and other services in 51.4-52.6 GHz. This facilitates harmonized worldwide bands for IMT, which are highly desirable in order to achieve global roaming and the benefits of economies of scale.

ADD USA/1.13/3

5.A113 The frequency band 50.4-52.6 GHz is identified for use by administrations wishing to implement the terrestrial component of International Mobile Telecommunications (IMT). This

identification does not preclude the use of this frequency band by any application of the services to which they are allocated and does not establish priority in the Radio Regulations.

Reasons: This facilitates harmonized worldwide bands for IMT, which are highly desirable in order to achieve global roaming and the benefits of economies of scale.

VIEW B

United States of America

PROPOSALS FOR THE WORK OF THE CONFERENCE

1. Agenda item 1.13

1.13 *to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC-15);*

Background:

Resolution **238 (WRC-15)** calls for studies to determine the spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz, as well as sharing and compatibility studies, taking into account the protection of services to which the frequency band is allocated on a primary basis, for the frequency bands:

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

It is important to note that the properties of higher frequency bands, such as shorter wavelength, would better enable the use of advanced antenna systems, including multiple-input and multiple-output (MIMO) and beam-forming techniques in supporting enhanced mobile broadband.

Spectrum needs studies conducted in response to Resolution 238 determined that 6.1 GHz of spectrum is needed for the terrestrial component of IMT in the frequency range 37-52.6 GHz. The United States, contrary to studies within the ITU-R, has proposed to make 7.5 GHz of spectrum in this range available to the terrestrial component of IMT, in the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz.

Further, several compatibility studies between the EESS/SRS (passive) in the frequency band 50.2-50.4 GHz and IMT in the frequency band 47.2-50.2 GHz have been conducted. All of these studies showed that IMT systems will cause exceedance of the EESS (passive) protection criteria, especially if IMT deployments by multiple operators are considered.

Data from EESS (passive) systems in this band plays a major role in many public safety activities such as:

- identifying areas at risk for natural disasters;
- forecasting weather and predicting climate change;
- detecting and tracking tsunamis, hurricanes, tornadoes, oil leaks, etc.;
- providing alerting/warning information of such disasters;
- assessing the damage caused by such disasters;
- providing information for planning relief operations; and
- monitoring recovery from a disaster.

This band is also being utilized by the Fixed Satellite Service for the deployment of both gateways and user terminals. Additionally, studies have shown the sharing is not feasible between FSS user terminals with undetermined locations and ubiquitous IMT.

Proposal:

Considering the potential impacts to EESS (passive), the infeasibility of sharing between FSS user terminals and IMT, and that the United States has proposed spectrum for the terrestrial component of IMT that exceeds, in aggregate, the spectrum needs, as determined by ITU-R studies, for the terrestrial component of IMT in the 37-52.6 GHz frequency range, NOC is proposed for the 50.4-52.6 GHz frequency band.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

NOC USA/4827A13/1

47.5-51.4 GHz

Allocation to services		
Region 1	Region 2	Region 3
* * *		
50.4-51.4	FIXED FIXED-SATELLITE (Earth-to-space) 5.338A MOBILE Mobile-satellite (Earth-to-space)	

Reasons: Because spectrum needs have been met and exceeded in other bands in the 37-52.6 GHz frequency range, and to protect EESS (passive) in the 50.2-50.4 GHz band and due to infeasibility of sharing between FSS user terminals and IMT, NOC is proposed for the 50.4-52.6 GHz frequency band.

NOC USA/4827A13/2

51.4-55.78 GHz

Allocation to services		
Region 1	Region 2	Region 3
51.4-52.6	FIXED 5.338A MOBILE 5.547 5.556	
52.6-54.25	EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 5.340 5.556	

54.25-55.78

EARTH EXPLORATION-SATELLITE (passive)
INTER-SATELLITE 5.556A
SPACE RESEARCH (passive)
5.556B

Reasons: Because spectrum needs have been met and exceeded in other bands in the 37-52.6 GHz frequency range, and to protect EESS (passive) in the 50.2-50.4 GHz band and due to infeasibility of sharing between FSS user terminals and IMT, NOC is proposed for the 50.4-52.6 GHz frequency band.

PROPOSALS FOR THE WORK OF THE CONFERENCE

2. Agenda item 1.13

1.13 *to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC-15);*

Background:

Resolution 238 (WRC-15) calls for studies to determine the spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz, as well as sharing and compatibility studies, taking into account the protection of services to which the frequency band is allocated on a primary basis, for the frequency bands:

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

Mobile broadband plays an increasingly crucial role in providing access to businesses and consumers worldwide. According to International Telecommunications Union (ITU) statistics, “Mobile-broadband subscriptions have grown more than 20% annually in the last five years and are expected to reach 4.3 billion globally by end 2017.” while “Mobile-broadband prices as a percentage of GNI per capita halved between 2013 and 2016 worldwide.³ The rising demand for mobile broadband has created increased capacity requirements in the backhaul or transport network. The 71–76 GHz and 81–86 GHz frequency ranges are important for the provision of Fixed Service (FS) backhaul for mobile broadband services. These frequency ranges offer very wide bandwidth, enabling capacities on the order of 10 Gigabit per second or more over distances of a few kilometers and represent an alternative to fiber deployment: this data rate cannot be achieved in other frequency bands that are bandwidth-limited. It is expected that the demand for high-capacity backhaul will create momentum for the transition from lower bands to these frequency ranges. Point-to-point microwave radios used by FS are a key component in many mobile networks, as well as Fixed Service microwave links for various uses including broadcast, utilities and public safety. The 71-76 GHz and 81-86 GHz frequency ranges are expected to experience major growth in Fixed Service use and represent up to 20 percent of new backhaul deployments annually by 2020. .

In order to provide important backhaul services including those which support IMT-2020 deployments, no changes are proposed for the 71-76 GHz and 81-86 GHz frequency ranges.

Proposals:

³ ICT Facts and Figures 2017, p 4 and 5. See: <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf>

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

NOC USA/1.13/1

66-81 GHz

Allocation to services		
Region 1	Region 2	Region 3
71-74	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)	
74-76	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE BROADCASTING BROADCASTING-SATELLITE Space research (space-to-Earth) 5.561	

Reasons: In order to utilize these frequency bands to provide important backhaul services for IMT-2020, no changes are proposed.

NOC USA/1.13/2

81-86 GHz

Allocation to services		
Region 1	Region 2	Region 3
81-84	FIXED 5.338A FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Space research (space-to-Earth) 5.149 5.561A	
84-86	FIXED 5.338A FIXED-SATELLITE (Earth-to-space) 5.561B MOBILE RADIO ASTRONOMY 5.149	

Reasons: In order to utilize these frequency bands to provide important backhaul services for IMT-2020, no changes are proposed.

Satellite Service Issues

United States of America

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.2

Agenda Item 1.2: *to consider in-band power limits for earth stations operating in the mobile-satellite service, meteorological-satellite service, and Earth exploration-satellite service in the frequency bands 401-403 MHz and 399.9-400.05 MHz, in accordance with Resolution 765 (WRC-15)*

BACKGROUND: Resolution 765 (WRC-15) resolves to invite the WRC-19 to take into account the results of ITU-R studies and consider the possibility of establishing in-band power limits for Earth stations in the Earth exploration-satellite service (EESS) and meteorological-satellite service (MetSat) in the frequency bands 401- 403 MHz and in the mobile-satellite service (MSS) frequency band 399.9-400.05 MHz.

Earth stations operating in the EESS and MetSat in the frequency band 401-403 MHz and in the MSS in the frequency band 399.9-400.05 MHz are used for data collection systems (DCS) uplinks. These DCS usually operate most efficiently together by using moderate to low equivalent isotropic radiated power (e.i.r.p) levels, resulting in small link margins.

Recommendation ITU-R SA.2045 provides information on the performance and interference criteria for relevant geostationary-satellite orbit (GSO) and non-geostationary satellite (non-GSO) DCS in the frequency band 401-403 MHz. Recommendation ITU-R SA.2044 provides information on the current and future usage of non-GSO DCS in the frequency band 401-403 MHz and the portioning of the frequency band to allow all DCS equal access to the spectrum. Recommendation ITU-R M.2046 provides a description, and the corresponding protection criteria for broadband noise and narrowband interference, of one MSS system that uses the frequency band 399.9-400.05 MHz (Earth-to-space).

DCS stations are deployed worldwide and communicate with GSO and non-GSO satellites are deployed worldwide for the purpose of collecting essential weather and climate data. The Data Collection Platforms (DCP) gather information activity related to the Earth, environmental and scientific applications, weather, environment observation: meteorological and oceanographic, seismic observation, volcanology, geodesy and geodynamics, fishing vessel monitoring, wildlife tracking, homeland security, law enforcement, test/evaluation, monitoring shipments of dangerous goods, humanitarian applications, managing water resources or tsunami warning system. The data collected by DCPs are transmitted to satellites that relay the retrieved information to dedicated earth stations. EESS, MetSat, and MSS systems are necessary for monitoring and predicting climate change and monitoring oceans, weather, and water resources.

There is a growing interest in using these frequency bands for critical satellite telecommand purposes under the EESS, MetSat, and MSS allocations. The output power levels of these Earth stations at the antenna port for telecommand links (Earth-to-space) may be much higher than the typical moderate to low power levels traditionally used for the operation of EESS, MetSat, and MSS DCS systems in the frequency bands 401-403 MHz and 399.9-400.05 MHz.

ITU-R studies are considering (i) in-band power limits for earth stations operating in the frequency ranges 399.9-400.05 MHz in the MSS and 401-403 MHz in the EESS and MetSat services and (ii) potential mitigation measures that, if employed, would allow some satellite telecommand operations to continue indefinitely in both frequency bands.

Proposal:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD USA/AI 1.2/1

335.4-410 MHz

Allocation to services		
Region 1	Region 2	Region 3
399.9-400.05	MOBILE-SATELLITE (Earth-to-space) 5.209 5.220 ADD 5.A102	
400.05-400.15	STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (400.1 MHz) 5.261 5.262	
400.15-401	METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208A 5.208B 5.209 SPACE RESEARCH (space-to-Earth) 5.263 Space operation (space-to-Earth) 5.262 5.264	
401-402	METEOROLOGICAL AIDS SPACE OPERATION (space-to-Earth) EARTH EXPLORATION-SATELLITE (Earth-to-space) ADD 5.B102 5.C102 5.D102 METEOROLOGICAL-SATELLITE (Earth-to-space) ADD 5.B102 5.C102 5.D102 Fixed Mobile except aeronautical mobile	

402-403	METEOROLOGICAL AIDS
	EARTH EXPLORATION-SATELLITE (Earth-to-space) ADD 5.B102
	5.C102 5.D102
	METEOROLOGICAL-SATELLITE (Earth-to-space) ADD 5.B102
	5.C102 5.D102
	Fixed
	Mobile except aeronautical mobile

Reasons: Studies have shown that to protect the existing and future operation of DCS in the MSS, EESS, and MetSat services new regulatory provisions are needed to address (i) in-band power limits applicable to Earth stations and (ii) mitigation measures that will allow some satellite telecommand operations continue indefinitely.

ADD USA/AI 1.2/2

5.A102 In the frequency band 399.9-400.03 MHz, the maximum e.i.r.p. transmission at the input of the antenna from any Earth stations (Earth-to-space) in the mobile-satellite service shall not exceed 5 dBW. This limit shall apply after 22 November 2024 for which complete notification information is received by the Radiocommunication Bureau before 22 November 2019. Administrations are encouraged to take all efforts to comply with the maximum e.i.r.p limit in the frequency band 399.9-400.03 MHz prior to 22 November 2024.

Reason: Establishes Earth station maximum e.i.r.p. limit to ensure the continued operations of non-GSO data collection systems in the frequency band and permits continued satellite telecommand operations in the 400.03-400.05 MHz segment of the band while protecting DCS.

USA/AI 1.2/3

ADD

5.B102 In the frequency band 401-403 MHz, the maximum e.i.r.p. transmission at the input of the antenna from any Earth stations (Earth-to-space) in the meteorological-satellite service and the Earth exploration-satellite service shall not exceed 22 dBW for geostationary-satellite orbit systems and non-geostationary-satellite orbit systems with an orbital apogee equal to or greater than 35 786 km and 7 dBW for non-geostationary-satellite orbit systems with an orbital apogee lower than 35 786 km.

After 22 November 2024, these limits shall apply to all systems, except telecommand systems for which complete notification information has been received by the Radiocommunication Bureau before 22 November 2019 and brought into use before 22 November 2019, in the meteorological-satellite service and the Earth exploration-satellite service operating in this frequency band.

Administrations are encouraged to take all efforts to comply with the maximum e.i.r.p limits in the frequency band 401-403 MHz prior to 22 November 2024.

Reasons: Establishes Earth station maximum e.i.r.p. limit to ensure the continued operations of DCS in the frequency band and permits some continued satellite telecommand in the frequency band while protecting DCS.

ADD USA/AI 1.2/4

5.C102 Operations for telecommand in the band 401-403 MHz after 22 November 2024 shall comply with DRAFT NEW RESOLUTION [TBD] (WRC-19). (WRC-19)

Reason: Provides a new WRC Resolution that would permit some continued satellite telecommand operations in the frequency band while protecting DCS.

ADD USA/AI 1.2/5

5.D102 In the frequency band 401.898-402.522 MHz, the maximum e.i.r.p. transmission at the input of the antenna from Earth stations (Earth-to-space) of associated satellite system for which complete notification information was received by the Radiocommunication Bureau on 28 April 2007 may continue to be used at that permitted level.

Reasons: This provision provides flexibility to existing Earth station(s) of the associated non-GSO system, and it ensures the continued operation of this non-GSO DCS.

ADD USA/AI 1.2/6

DRAFT NEW RESOLUTION [TBD] (WRC-19)

Transitional measures for existing satellite networks and systems of the meteorological-satellite service (Earth-to-space) and the Earth exploration-satellite service (Earth-to-space) in the frequency band 401-403 MHz

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

considering

- a) that data collection systems (DCS) operate on geostationary and non-geostationary orbits in the meteorological-satellite service (MetSat) and the Earth exploration-satellite service (EESS) (Earth-to-space) systems in the frequency band 401-403 MHz;

b) that DCS are essential for monitoring and predicting climate change, monitoring oceans, and water resources, weather forecasting and assisting in protecting biodiversity and improving maritime security;

c) that the frequency band 401-403 MHz is also used for the uplink of critical mission and telemetry data for meteorological and Earth exploration purposes;

d) that the World Radiocommunication Conference 2019 (WRC-19) has created a 7 dBW eirp limit for all systems in the frequency band 401-403 MHz after 22 November 2024 in No. **5.B102** to provide protection of existing and future DCS;

noting

a) that several EESS and MetSat satellite networks and systems in the frequency band 401-403 MHz were notified and brought into use before 22 November 2019;

b) that some of these EESS and MetSat satellite networks and systems, completing operations in *considering c)*, above may not meet the eirp limit in *considering d)*;

resolves

that the frequency assignment of MetSat (Earth-to-space) and EESS (Earth-to-space) satellite network in the frequency band 401-403 MHz for which complete notification information was received by the Radiocommunication Bureau prior to the end of WRC-19 and which space stations do not meet the eirp limits stated in No. **5.B102** shall be used on a primary basis with respect to the DCS after 22 November 2024 as stipulated in the Annex to this Resolution;

instructs the Director of the Radiocommunication Bureau

for the frequency assignment of MetSat (Earth-to-space) and EESS (Earth-to-space) satellite network for which complete notification information was received by the Radiocommunication Bureau prior to the end of WRC-19, the Bureau shall review the finding under No. **11.50** without proposal to the administration that it submit a new assignment to replace the previous one. The original date of such assignment in the Master International Frequency Register (MIFR) shall be kept.

ANNEX TO DRAFT NEW RESOLUTION [TBD] (WRC-19)

Transitional measures for existing satellite networks and systems of the meteorological-satellite service (Earth-to-space) and the Earth exploration-satellite service (Earth-to-space) in the frequency band 401-403 MHz

1 EESS and MetSat satellite networks and systems, falling under *noting b)*, shall implement the following mitigation measures to maintain operations after 22 November 2024.

2 EESS and MetSat satellite networks and systems, falling under *noting b)*, shall only operate in the GSO-only DCS segments of the frequency band 401-403 MHz as outlined in Recommendation ITU-R SA.2045. These segments are 401.2-401.3 MHz, 401.7-401.899 MHz, and 402.067-402.850 MHz.

3 EESS and MetSat satellite networks and systems, falling under *noting b)*, shall employ earth stations with antenna patterns with relative antenna gain pattern masks that achieve compliance with Recommendation ITU-R SA.1163. The earth stations shall avoid pointing at GSO DCS satellites sufficient for the antenna off-axis loss to reduce levels into the GSO DCS receivers to meet the relevant ITU-R thresholds for interference exceedance in Recommendation ITU-R SA.1163. Example antenna patterns are referenced in Figures 4 and 5 in Report ITU-R SA.2430.

Reasons: Allows continuation of some satellite telecommand operations in the EESS and MetSat frequency bands, with protection to all DCP operations, after 22 November 2024.

SUP USA/AI 1.2/7

RESOLUTION 765 (WRC-15)
**Establishment of in-band power limits for earth stations operating
in mobile-satellite service, the meteorological-satellite service and
the Earth exploration-satellite service in the frequency bands
401-403 MHz and 399.9-400.05 MHz**

Reasons: Consequential actions to establishing in-band power limits for Earth stations operating in the mobile-satellite service, the meteorological-satellite service and the Earth-exploration-satellite service in the frequency bands 399.9-400.05 MHz and 401-403 MHz.

Document WAC/087 (11.03.19)

1. IWG-3 Proposed changes to NTIA Proposal for WRC-19 Agenda item 1.3

2. UNITED STATES OF AMERICA

3. DRAFT PROPOSAL FOR WRC-19

Agenda Item 1.3: *to consider possible upgrading of the secondary allocation to the meteorological-satellite service (space-to-Earth) to primary status and a possible primary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band 460-470 MHz, in accordance with Resolution 766 (WRC-15)*

BACKGROUND: The frequency band 460-470 MHz is currently allocated to the fixed and mobile services on a primary basis and is widely used by these services. Resolution **766 (WRC-15)** states that there is a need to protect the fixed and mobile services in the frequency band 460-470 MHz and not to constrain their future development. Furthermore, RR No. **5.286AA** identifies the frequency band 450-470 MHz for use by administrations wishing to implement International Mobile Telecommunications (IMT).

Within this frequency band the Argos Data Collection System (ADCS) monitors more than 21,000 active Argos platforms collecting data for over 2,000 distinct projects in 100+ countries. The administration of the Argos program is under a joint agreement between the National Oceanic and Atmospheric Administration (NOAA) within the United States and the French Space Agency, Centre National d'Etudes Spatiales (CNES). Additional partners include the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), and the Indian Space Research Organization (ISRO).

Critical applications of the ADCS include atmospheric and ocean monitoring/research, tropical cyclone forecasting, fishery management, oil spill tracking, fishing vessel tracking, search and rescue modeling (at sea), anti-piracy alerting, import/export and hazardous materials tracking, endangered species studies, migration mapping, and wildlife tracking and management.

The meteorological-satellite (space-to-Earth) service operates on a secondary basis relative to the fixed and mobile services and thus it must not interfere with these services. To protect the fixed and land mobile services within the United States, a power flux density (pfd) of -152 dB(W/(m²·4kHz)) has been imposed on the meteorological-satellite (space-to-Earth) service.

In accordance with Resolution **766 (WRC-15)**, the ITU-R has conducted sharing studies to ensure the protection of incumbent services and has developed a pfd limit that will protect incumbent services globally from potential interference in the frequency band 460 – 470 MHz. The Report ITU-R SA.2429 provides the studies and compiles elements related to WRC-19 agenda item 1.3. This Report also

includes initial technical considerations on EESS and MetSat in the 460-470 MHz band and other services allocated in this band

Studies have demonstrated that sharing is possible between meteorological-satellite (space-to-Earth)/earth-exploration-satellite (space-to-Earth) services and the incumbent services in the 460 – 470 MHz frequency band if the pfd limits proposed below are applied. Based on the results of sharing studies, this proposal supports an allocation upgrade from secondary to a primary for the meteorological-satellite service (space-to-Earth) and a new primary allocation to the earth-exploration-satellite (space-to-Earth) service in the frequency band 460 – 470 MHz band. This proposal applies a set of elevation angle dependent pfd limits to the meteorological-satellite and earth exploration-satellite services to protect the incumbent services globally.

Proposal:

ARTICLE 5
Frequency allocations

Section IV – Table of Frequency Allocations

(See No. 2.1)

MOD USA/AI 1.3/1

460-470 MHz

Allocation to services		
Region 1	Region 2	Region 3
460-470	FIXED MOBILE 5.286AA METEOROLOGICAL-SATELLITE (space-to-Earth) EARTH EXPLORATION-SATELLITE (space-to-Earth) 5.287 5.288 ADD 5.A13	

SUP USA/AI 1.3/2

5.290 *Different category of service:* in Afghanistan, Azerbaijan, Belarus, China, the Russian Federation, Japan, Kyrgyzstan, Tajikistan, and Turkmenistan, the allocation of the band 460-470 MHz to the meteorological-satellite service (space-to-Earth) is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. (WRC-12)

ADD USA/AI 1.3/3

5.A13 In the frequency band 460-470 MHz, Resolution [A13] (WRC-19) shall apply. (WRC-19)

MOD USA/AI 1.3/4

Allocation to services		
Region 1	Region 2	Region 3
1 690-1 700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) Fixed Mobile except aeronautical mobile MOD 5.289 5.341 5.382	1 690-1 700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) MOD 5.289 5.341 5.381	

1 700-1 710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MOD 5.289 5.341	1 700-1 710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MOD 5.289 5.341 5.384
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MOD USA/AI 1.3/5

5.289 Earth exploration-satellite service applications, other than the meteorological-satellite service, may also be used in the band 1 690-1 710 MHz for space-to-Earth transmissions subject to not causing harmful interference to stations operating in accordance with the Table. (Rev. WRC-19)

APPENDIX 7 (REV.WRC-15)

Methods for the determination of the coordination area around an earth station in frequency bands between 100 MHz and 105 GHz

ANNEX 7

System parameters and predetermined coordination distances for determination of the coordination area around an earth station

4. 3 Horizon antenna gain for a receiving earth station with respect to a transmitting earth station

TABLE 8a (Rev. WRC-19)

Parameters required for the determination of coordination distance for a receiving earth station

Receiving space radiocommunication service designation	Space operation, space research	Meteorological satellite, mobile-satellite	Space research, space operation	Space operation	Mobile-satellite	Meteorological satellite	Mobile-satellite	Space research	Space operation	Broad-casting-satellite	Mobile-satellite	Broadcasting-satellite (DAB)	Mobile-satellite, land-mobile satellite, maritime mobile-satellite
Frequency bands (MHz)	137-138	137-138	174-184 143.6-143.65	163-167 272-273 ⁵	335.4-399.9	400.15-401	400.15-401	400.15-401	401-402	620-790	856-890	1 452-1 492	1 518-1 530 1 555-1 559 2 160-2 200 ¹
Transmitting service designations	terrestrial	Fixed, mobile	Fixed, mobile, radio-location	Fixed, mobile	Fixed, mobile	Meteorological aids	Meteorological aids	Meteorological aids	Meteorological aids, fixed, mobile	Fixed, mobile, broad-casting	Fixed, mobile, broad-casting	Fixed, mobile, broadcasting	Fixed, mobile
Method to be used	§ 2.1	§ 2.1	§ 2.1	§ 2.1	§ 1.4.6	§ 1.4.6	§ 1.4.6	§ 1.4.6	§ 2.1	§ 1.4.5	§ 1.4.6	§ 1.4.5	§ 1.4.6
Modulation at earth station ²	N	N	N	N				N	N			N	N
Earth station	0.1	0.1	0.1	1.0		0.012		0.1	0.1				10
interference parameters	2	2	2	1		1		2	2				1
and criteria	0.05	0.05	0.05	1.0		0.012		0.05	0.05				10
N_L (dB)	0	0	0	0		0		0	0				0
M_2 (dB)	1	1	1	1		4.3		1	1				1
W (dB)	0	0	0	0		0		0	0				0
Terrestrial station	A	-	-	15				-	-			38	37.4
parameters	N	-	-	15				-	-			38	37
P_f (dBW)	A	-	-	-1				-	-			3	0
in B	N	-	-	-1				-	-			3	0
G_x (dB)	-	-	-	16				-	-			35	37
Reference bandwidth	1	1	1	10 ³		177.5 × 10 ³		1	1			25 × 10 ³	4 × 10 ³
Permissible interference power	-199	-199	-199	-173		-148		-208	-208				-176

¹ In the band 2 160-2 200 MHz, the terrestrial station parameters of line-of-sight radio-relay systems have been used. If an administration believes that, in this band transhorizon systems need to be considered, the parameters associated with the frequency band 2 500-2 690 MHz may be used to determine the coordination area.

² A: analogue modulation; N: digital modulation.

³ E is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

⁴ This value is reduced from the nominal value of 50 dBW for the purposes of determination of coordination area, recognizing the low probability of high power emissions falling fully within the relatively narrow bandwidth of the earth station.

⁵ The fixed-service parameters provided in the column for 163-167 MHz and 272-273 MHz are only applicable to the band 163-167 MHz.

ADD USA/AI 1.3/7

DRAFT NEW RESOLUTION [A13] (WRC-19)

Implementation of satellite networks and systems of the meteorological-satellite service (space-to-Earth) and the Earth exploration-satellite service (space-to-Earth) in the frequency band 460-470 MHz

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

considering

- a)* that data collection systems (DCS) operate on geostationary and non-geostationary orbits in the meteorological-satellite service (MetSat) and the Earth exploration-satellite service (EESS) (Earth-to-space) in the frequency band 401-403 MHz;
- b)* that DCS are essential for monitoring and predicting climate change, monitoring oceans, and water resources, weather forecasting and assisting in protecting biodiversity, improving maritime security;
- c)* that most of these DCS have implemented satellite downlinks (space-to-Earth) in the frequency band 460-470 MHz which bring significant improvements to the operation of satellite DCS, such as the transmission of information to optimize the usage of the terrestrial data collection platforms;
- d)* that the frequency band 460-470 MHz is also used for the downlink of mission and telemetry data for meteorological and Earth-exploration purposes;
- e)* that the frequency band 460-470 MHz is allocated to the fixed and mobile services on a primary basis and is identified for IMT on a global basis;
- f)* that WRC-19 has upgraded the secondary allocation of the MetSat (space-to-Earth) to primary status and added a primary allocation to the EESS (space-to-Earth) in the frequency band 460-470 MHz, and established a power flux-density (pfd) limit to provide protection of existing terrestrial services;
- g)* that the priority of MetSat systems over EESS systems in the frequency band 460-470 MHz is provided to ensure protection of MetSat systems from interference from the increasing number of small satellite systems operating in the EESS;
- h)* that WRC-19 suppressed No. **5.290** and the relevant parameters in Table **8a** of Appendix **7**, which identified some administrations that already have a primary allocation to the MetSat (space-to-Earth), subject to agreement obtained under No. **9.21**, in the light of the upgrade mentioned in *considering f)* above, and that it is necessary to provide some regulatory measures for satellite

systems which operate in accordance with No. **5.290** to retain their regulatory status after the end of WRC-19,

noting

a) that frequency assignments for several EESS and MetSat satellite systems in the frequency band 460-470 MHz were notified and brought into use;

b) that some of these EESS and MetSat satellite systems above may not meet the pfd limit in *considering f*), but there is a need to continue to authorize them for operations as secondary services in order to continue their operations,

resolves

1 that in the frequency band 460-470 MHz, the power flux-density at the Earth's surface produced by stations in the meteorological-satellite (space-to-Earth) and Earth exploration-satellite (space-to-Earth) services shall comply with the limits listed below under assumed free-space propagation conditions for all methods of modulation:

For non-GSO space stations:

$$pfd \left(\text{dBW} / \left(\text{m}^2 \cdot 4 \text{ kHz} \right) \right) = \begin{cases} -157 & 0^\circ \leq \alpha < 5^\circ \\ -157 + 0.5(\alpha - 5) & 5^\circ \leq \alpha < 15^\circ \\ -152 & 15^\circ \leq \alpha < 90^\circ \end{cases}$$

And for GSO space stations:

$$pfd \left(\text{dBW} / \left(\text{m}^2 \cdot 4 \text{ kHz} \right) \right) = \begin{cases} -162 & 0^\circ \leq \alpha < 15^\circ \\ -162 + 0.5(\alpha - 15) & 15^\circ \leq \alpha < 35^\circ \\ -152 & 35^\circ \leq \alpha < 90^\circ \end{cases}$$

where α is the angle of arrival above the horizontal plane, in degrees.

These limits apply to all space stations in the meteorological-satellite service and Earth exploration-satellite service in this frequency band for which complete notification information or coordination request or advance publication information was received by the Radiocommunication Bureau after the end of WRC-19;

2 that the satellite networks and systems in the meteorological-satellite (space-to-Earth) and Earth exploration-satellite (space-to-Earth) services in the frequency band 460-470 MHz for which a complete or advance publication information or coordination request or notification information has been received by the Radiocommunication Bureau prior to the end of WRC-19, and whose space stations meet the pfd limits given in *resolves 1*, may continue to operate with the same parameters under Appendix 4 submitted for coordination or notification;

3 that the frequency assignment of MetSat (space-to-Earth) and EESS (space-to-Earth) satellite network and systems in the frequency band 460-470 MHz for which complete notification information or coordination request or advance publication information was received by the Radiocommunication Bureau prior to the end of WRC-19 and whose space stations do not meet the pfd limits given in *resolves 1* shall be used on a secondary basis with respect to the fixed and mobile service stations;

4 that the satellite systems in the meteorological-satellite service (space-to-Earth) referred to in *considering h*) for which complete coordination information related to No. **9.21** has been received by the Radiocommunication Bureau prior to the end of WRC-19 shall operate on a primary

basis, and that, for those systems, the relevant provisions of Articles **9** and **11** continue to apply, and the relevant agreements obtained under No. **9.21** remain in force after the end of WRC-19;

5 that the MetSat and EESS in the 460-470 MHz band shall not limit the development or the deployment of the fixed, mobile and broadcast services allocated in the 460-470 MHz and adjacent bands;

6 that in the frequency band 460-470 MHz, stations in the meteorological-satellite service (space-to-Earth) and Earth exploration-satellite service (space-to-Earth) shall not claim protection from stations of the fixed and mobile services in the frequency band 460-470 MHz unless other agreements were obtained under No. **9.21** prior to the end of WRC-19;

7 that in the frequency band 460-470 MHz, stations in the Earth exploration-satellite service (space-to-Earth) shall not cause harmful interference to earth stations in the meteorological-satellite service (space-to-Earth),

instructs the Director of the Radiocommunication Bureau

for the frequency assignment of MetSat (space-to-Earth) and EESS (space-to-Earth) satellite network for which complete notification information or coordination request was received by the Radiocommunication Bureau prior to the end of WRC-19, the Bureau shall review the finding under No. **11.50** without requiring the administration to submit a new assignment. The date of such assignment's original recording in the Master International Frequency Register (MIFR) shall remain unchanged.

SUP USA/AI 1.3/8

RESOLUTION 766 (WRC-15)

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

Regulatory Issues

UNITED STATES OF AMERICA
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 7, Issue F – Measures to facilitate entering new assignments into the RR Appendix 30B List

Background Information:

An administration wishing to convert its national allotment in RR Appendix 30B to assignments with characteristics beyond those of the initial allotment or wishing to introduce a new network will be faced with several difficulties. Two of these are:

- due to the conservative criteria used in RR Appendix 30B, a large number of coordination requirements are identified;
- networks can be designed with combinations of characteristics, possibly unrealistic, to obtain a high sensitivity to interference from later submissions.

The ITU-R performed extensive studies to determine changes to the coordination triggers in RR Appendix 30B to alleviate the above identified difficulties and minimize the administrative burden of completing coordinations that are not necessary in practice, while maintain full protection of RR Appendix 30B allotments and existing systems. The United States supports the changes to RR Appendix 30B espoused in Method F1 of the CPM text to take advantage of the results of these studies. This Method facilitates coordination of new networks and hence eases access of administrations to the frequency bands of RR Appendix 30B, by updating the coordination triggers in Appendix 30B to take into account technological advances and avoid some unnecessary coordination while assuring adequate protection of other satellite networks. This changes will benefit submissions for new networks, including those of newcomers and those of administrations seeking to convert their national allotments into assignments with changes.

The proposed changes include modifying the RR Appendix 30B coordination triggers to be similar to those adopted in RR Appendices 30 and 30A by WRC-2000, specifically:

- Bringing the size of the coordination arc in line with that used for the unplanned frequency bands, i.e. 7° for C-band and 6° for Ku-band and consequently align the Annex 3 limits to the newly established coordination arcs;
- Introducing pfd masks and levels like in RR Appendices 30 and 30A as well as in portions of the unplanned frequency bands to remove unnecessary coordination and prevent combinations of technical parameters leading to unrealistic links from hindering introduction of new networks. The proposed values for the pfd masks and levels are those developed in preparation for WRC-15, based on a level of protection corresponding to $\Delta T/T = 6\%$ for C-band antennas with a diameter between 1.2 and 18 m and Ku-band antennas with a diameter between 45 cm and 11 m).

Proposal:

APPENDIX 30B (REV.WRC-15)

Provisions and associated Plan for the fixed-satellite service in the frequency bands 4 500-4 800 MHz, 6 725-7 025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz

MOD USA/7/F/1

ANNEX 3 (REV.WRC-19)

Limits applicable to submissions received under Article 6 or Article 7^{MOD 15}

Under assumed free-space propagation conditions, the power flux-density (space-to-Earth) of a proposed new allotment or assignment produced on any portion of the surface of the Earth shall not exceed:

- -131.4^* dB(W/(m² · MHz)) in the 4 500-4 800 MHz frequency band; and
- -118.4^* dB(W/(m² · MHz)) in the 10.70-10.95 GHz and 11.20-11.45 GHz frequency bands.

Under assumed free-space propagation conditions, the power flux-density (Earth-to-space) of a proposed new allotment or assignment shall not exceed:

- -140.0 dB(W/(m² · MHz)) towards any location in the geostationary-satellite orbit located more than 7° from the proposed orbital position in the 6 725-7 025 MHz frequency band, and
- -133.0 dB(W/(m² · MHz)) towards any location in the geostationary-satellite orbit located more than 6° from the proposed orbital position in the 12.75-13.25 GHz frequency band.

*NOTE – These are consequential changes to the proposed reduction of the coordination arc from 10° to 7° in the 4 GHz frequency band and from 9° to 6° in the 10/11 GHz frequency band. Should other sizes of the coordination arc be considered by WRC-19, the power flux-densities should be amended according to the equation: $pdf_{new} = pdf_{current} - 25 \cdot \log(\text{current coordination arc} / \text{new coordination arc})$.

Reasons: These changes align the pfd limits with the proposed modified coordination arc in Annex 4 of RR Appendix **30B**, ensuring protection of existing allotments and systems in the uplink direction while facilitating modified allotments and new entries.

¹⁵ These limits shall not apply to assignments submitted in accordance with Article 6 or recorded in the List before 22 November 2019.

ANNEX 4 (REV.WRC-19)

Criteria for determining whether an allotment or an assignment is considered to be affected

An allotment or an assignment is considered as being affected by a proposed new allotment or assignment:

1 if the orbital spacing between its orbital position and the orbital position of the proposed new allotment or assignment is equal to or less than:

1.1 7° in the 4 500-4 800 MHz (space-to-Earth) and 6 725-7 025 MHz (Earth-to-space) frequency bands;

1.2 6° in the 10.70-10.95 GHz (space-to-Earth), 11.20-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) frequency bands.

2 However, an administration is considered as not being affected if at least one of the following conditions is satisfied:

2.1 the calculated¹⁶ Earth-to-space single-entry carrier-to-interference $(C/I)_u$ value at each test point associated with the allotment or assignment under consideration is greater than or equal to a reference value that is 30 dB, or $(C/N)_u + 9$ dB¹⁷, whichever is the lowest and the calculated¹⁶ space-to-Earth single-entry $(C/I)_d$ value everywhere within the service area of the allotment or assignment under consideration is greater than or equal to a reference value¹⁹ that is 26.65 dB, or $(C/N)_d + 11.65$ dB²⁰, whichever is the lowest and the calculated¹⁶ overall aggregate $(C/I)_{agg}$ value at each test point associated with the allotment or assignment under consideration, is greater than or equal to a reference value that is 21 dB, or $(C/N)_i + 7$ dB²¹, or any already accepted overall aggregate $(C/I)_{agg}$ value, whichever is the lowest, with a tolerance of 0.25 dB²² in the case of assignments not stemming from the conversion of an allotment into an assignment without modification, or when the modification is within the envelope characteristics of the initial allotment.

2.2 in the 4 500-4 800 MHz (space-to-Earth) frequency band, the pfd produced under assumed free-space propagation conditions does not exceed the threshold values shown below, anywhere within the service area of the allotment or assignment under consideration:

	θ	\leq	0.09	-243.5	dB(W/(m ² · Hz))	
0.09	$<$	θ	\leq	3	$-243.5 + 20\log(\theta/0.09)$	dB(W/(m ² · Hz))
3	$<$	θ	\leq	5.5	$-219.8 + 0.75 \cdot \theta^2$	dB(W/(m ² · Hz))
5.5	$<$	θ	$<$	7	$-196.8 + 25\log(\theta/5.6)$	dB(W/(m ² · Hz))

where θ denotes nominal geocentric separation (degrees) between interfering and interfered-with satellite networks;

in the 6 725-7 025 MHz (Earth-to-space) frequency band, the pfd produced at the location in the geostationary-satellite orbit of the allotment or assignment under

¹⁸(SUP – WRC-19)

consideration under assumed free-space propagation conditions does not exceed $-204.0 \text{ dB(W/(m}^2 \cdot \text{Hz))}$;

in the 10.7-10.95 and 11.2-11.45 GHz (space-to-Earth) frequency bands, the pfd produced under assumed free-space propagation conditions does not exceed the threshold values shown below, anywhere within the service area of the allotment or assignment under consideration:

	θ	\leq	0.05	-238.0	$\text{dB(W/(m}^2 \cdot \text{Hz))}$	
0.05	$<$	θ	\leq	3	$-238.0 + 20\log(\theta/0.05)$	$\text{dB(W/(m}^2 \cdot \text{Hz))}$
3	$<$	θ	\leq	5	$-210.9 + 0.95 \cdot \theta^2$	$\text{dB(W/(m}^2 \cdot \text{Hz))}$
5	$<$	θ	$<$	6	$-187.2 + 25\log(\theta/5)$	$\text{dB(W/(m}^2 \cdot \text{Hz))}$

where θ denotes nominal geocentric separation (degrees) between interfering and interfered-with satellite networks;

in the 12.75-13.25 GHz (Earth-to-space) frequency band, the pfd produced at the location in the geostationary-satellite orbit of the allotment or assignment under consideration under assumed free-space propagation conditions does not exceed $-208.0 \text{ dB(W/(m}^2 \cdot \text{Hz))}$.

Reasons: These changes to the coordination trigger in Annex 4 of RR Appendix **30B** protects existing allotments and systems while facilitating modified allotments and new entries.

United States

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 7

Issue H

7 *to consider possible changes, and other options, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, an advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution 86 (Rev.WRC-07), in order to facilitate rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;*

Resolution **86 (Rev.WRC-07)** – *Implementation of Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference*

Agenda item 7(H)

Issue H – Modifications to RR Appendix 4 data items to be provided for non-geostationary satellite systems with multiple orbital planes

BACKGROUND:

Issue H relates to the need to ensure that RR Appendix 4 data items sufficiently describe non-geostationary (non-GSO) satellite systems in order for:

- potentially affected administrations to be able to identify the potential impacts of these systems on their own systems and to formulate their comments to the notifying administration and the Radiocommunication Bureau;
- the Radiocommunication Bureau to be able to perform an examination with respect to compliance with the RR Article 22 efd limits based on the latest version of the algorithm contained in Recommendation ITU-R S.1503; and
- administrations and the Radiocommunication Bureau to understand whether the frequency assignments to a non-GSO satellite system define a single non-GSO system or multiple mutually exclusive configurations and, in the case of the latter, the nature of the mutually exclusive configurations.

PROPOSALS:

The following modifications to Appendix 4 Annex 2 are proposed in order to improve the description of non-GSO satellite systems as indicated in the background.

APPENDIX 4 (REV.WRC-15)

**Consolidated list and tables of characteristics for use in the
application of the procedures of Chapter III**

ANNEX 2

**Characteristics of satellite networks, earth stations
or radio astronomy stations² (Rev.WRC-12)**

Footnotes to Tables A, B, C and D

TABLE A
**GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK,
 EARTH STATION OR RADIO ASTRONOMY STATION** (Rev.WRC-19)

		<p style="text-align: center;"><i>A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION</i></p>										
Items in Appendix		Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	
A.4.b											A.4.b	
A.4.b.1			X			X					A.4.b.1	
A.4.b.1.a			X	X		X					A.4.b.1.a	

Items in Appendix	<p style="text-align: center;">A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION</p> <p>Indicator of whether all the orbital planes identified under A.4.b.1 describe a single configuration where all frequency assignments to the satellite system will be in use, or b), multiple configurations are mutually exclusive where a sub-set of the frequency assignments to the satellite system will be in use on one of the sub-sets of orbital parameters to be determined at the notification and recording stage of the satellite system Required only for the: 1) advance publication information of a non-geostationary satellite system representing a constellation (A.4.b.1.a), and 2) coordination request of non-geostationary-satellite systems</p> <p>In case the orbital planes identified under A.4.b.1 describe multiple mutually exclusive configurations, identification of the number of sub-sets of orbital characteristics that are mutually exclusive Required only for the: 1) advance publication information of a non-geostationary satellite system representing a constellation (A.4.b.1.a), and 2) coordination request for non-geostationary-satellite systems</p>	A.4.b.1.b	A.4.b.1.c
Advance publication of a geostationary-satellite network			
Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9			
Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	+	+	
Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)			
Notification or coordination of a non-geostationary-satellite network	+	+	
Notification or coordination of an earth station (including notification under Appendices 30A or 30B)			
Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)			
Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)			
Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)			
Items in Appendix		A.4.b.1.b	A.4.b.1.c
Radio astronomy			

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.4.b.1.d	In case the orbital planes identified under A.4.b.1.b describe multiple mutually exclusive configurations, identification of the orbital planes id numbers that are associated with each of the mutually exclusive configurations Required only for the: 1) advance publication information of a non-geostationary satellite system representing a constellation (A.4.b.1.a), and 2) coordination request of non-geostationary satellite systems		+	+		+					A.4.b.1.d	
A.4.b.2	the reference body code	X	X	X		X					A.4.b.2	
A.4.b.3	For space stations of a non-geostationary fixed-satellite service system operating in the frequency band 3 400-4 200 MHz:										A.4.b.3	
A.4.b.3.a	the maximum number of space stations (N_s) in a non-geostationary-satellite system simultaneously transmitting on a co-frequency basis in the fixed-satellite service in the Northern Hemisphere		X	X		X					A.4.b.3.a	
A.4.b.3.b	the maximum number of space stations (N_s) in a non-geostationary-satellite system simultaneously transmitting on a co-frequency basis in the fixed-satellite service in the Southern Hemisphere		X	X		X					A.4.b.3.b	
A.4.b.4	For each orbital plane, where the Earth is the reference body:										A.4.b.4	
A.4.b.4.a	the angle of inclination (i_j) of the orbital plane with respect to the Earth's equatorial plane ($0^\circ \leq i_j < 180^\circ$)		X	X		X					A.4.b.4.a	
A.4.b.4.b	the number of satellites in the orbital plane		X	X		X					A.4.b.4.b	

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.4.b.4.c	the period		X	X		X				A.4.b.4.c		
A.4.b.4.d	the altitude, in kilometres, of the apogee of the space station		X	X		X				A.4.b.4.d		
A.4.b.4.e	the altitude, in kilometres, of the perigee of the space station		X	X		X				A.4.b.4.e		
A.4.b.4.f	the minimum altitude of the space station above the surface of the Earth at which any satellite transmits		X	X		X				A.4.b.4.f		
A.4.b.4.g	the right ascension of the ascending node (Ω_j) for the j -th orbital plane, measured counter-clockwise in the equatorial plane from the direction of the vernal equinox to the point where the satellite makes its South-to-North crossing of the equatorial plane ($0^\circ \leq \Omega_j < 360^\circ$), determined at the reference time indicated in A.4.b.4.k and A.4.b.4.l. Required only for space stations operating in a frequency band subject to the provisions of Nos. 9.12 or 9.12A <i>Note</i> - All satellites in all orbital planes must use the same reference time. If no reference time is provided in A.4.b.4.k and A.4.b.4.l, it is assumed to be $t=0$					+				A.4.b.4.g		

Items in Appendix	<p style="text-align: center;">A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION</p> <p>the initial phase angle (ω_i) of the i-th satellite in its orbital plane at reference time $t = 0$, measured from the point of the ascending node ($0^\circ \leq \omega_i < 360^\circ$)</p> <p>Required only in case of a non-geostationary satellite system representing a "constellation" (A.4.b.1.a), and to be specified in:</p> <ol style="list-style-type: none"> 1) the Advanced Publication (API), for any frequency assignment not subject to the provisions of Section II of Article 9 2) the Coordination Request (CR/C), for any frequency assignment subject to the provisions of Nos. 9.12, 9.12A, 22.5C, 22.5D or 22.5F 3) the Notification, in all cases <p><i>Note</i> - The initial phase angle is the argument of perigee plus the true anomaly</p> <p>the argument of perigee (ω_p), measured in the orbital plane, in the direction of motion, from the ascending node to the perigee ($0^\circ \leq \omega_p < 360^\circ$)</p> <p>Required only for orbits of a "constellation" (A.4.b.1.a) where the altitudes of apogee and perigee (A.4.b.4.d and A.4.b.4.e) are different and to be specified in:</p> <ul style="list-style-type: none"> - the Advanced Publication (API), for any frequency assignment not subject to the provisions of Section II of Article 9 - the Coordination Request (CR/C), for any frequency assignment subject to the provisions of Nos. 9.12, 9.12A, 22.5C, 22.5D or 22.5F - the Notification, in all cases 	A.4.b.4.h	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including Appendices 30A or 30B)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	A.4.b.4.i	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including Appendices 30A or 30B)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.4.b.4.h		A.4.b.4.h									A.4.b.4.i										A.4.b.4.i		

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.4.b.4.n	if the space station uses sun-synchronous orbit (A.4.b.4.m), indicator if the space station references the local time of the ascending node (solar local time when the space station is crossing the equator plane in the South-North direction in hours:minutes format) or the descending node (solar local time when the space station is crossing the equator plane in the North-South direction in hours:minutes format)		O	O		O					A.4.b.4.n	
A.4.b.4.o	if the space station uses sun-synchronous orbit (A.4.b.4.m), the local time of the ascending (or descending, per A.4.b.4.n) node (solar local time when the space station is crossing the equator plane in the South-North (or North-South) direction in hours:minutes format)		O	O		O					A.4.b.4.o	
A.4.b.5	Not used											
A.4.b.6	For space stations operating in a frequency band subject to Nos. 22.5C, 22.5D or 22.5F, additional data elements to characterize properly the orbital operation of the non-geostationary-satellite system:										A.4.b.6	
A.4.b.6bis	An indicator showing whether the set of operating parameters is provided in A.14.d (extended set of operating parameters) or provided in A.4.b.6.a and A.4.b.7 (limited set of operating parameters)					X					A.4.b.6bis	
A.4.b.6.a	For each range of latitudes: the limited set of operating parameters										A.4.b.6.a	
A.4.b.6.a.1	the maximum number of non-geostationary satellites transmitting with overlapping frequencies to a given location										A.4.b.6.a.1	
A.4.b.6.a.2	the associated start of the latitude range										A.4.b.6.a.2	

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.4.b.6.a.3	the associated end of the latitude range					+					A.4.b.6.a.3	
A.4.b.6.b	Not used										A.4.b.6.b	
A.4.b.6.c	an indicator showing whether the space station uses station-keeping to maintain a repeating ground track					X					A.4.b.6.c	
A.4.b.6.d	if the space station uses station-keeping to maintain a repeating ground track, the time in seconds that it takes for the constellation to return to its starting position, i.e. such that all satellites are in the same location with respect to the Earth and each other					+					A.4.b.6.d	
A.4.b.6.e	an indicator showing whether the space station should be modelled with a specific precession rate of the ascending node of the orbit instead of the J_2 term					X					A.4.b.6.e	
A.4.b.6.f	if the space station is to be modelled with a specific precession rate of the ascending node of the orbit instead of the J_2 term, the precession rate in degrees/day, measured counter-clockwise in the equatorial plane					+					A.4.b.6.f	
A.4.b.6.g	Not used										A.4.b.6.g	
A.4.b.6.h	Not used										A.4.b.6.h	
A.4.b.6.i	Not used										A.4.b.6.i	
A.4.b.6.j	the longitudinal tolerance of the longitude of the ascending node					X					A.4.b.6.j	

Items in Appendix	<p style="text-align: center;">A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION</p>	<p style="text-align: center;">Advance publication of a geostationary-satellite network</p> <p style="text-align: center;">Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9</p> <p style="text-align: center;">Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9</p> <p style="text-align: center;">Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)</p> <p style="text-align: center;">Notification or coordination of a non-geostationary-satellite network</p> <p style="text-align: center;">Notification or coordination of an earth station (including notification under Appendices 30A or 30B)</p> <p style="text-align: center;">Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)</p> <p style="text-align: center;">Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)</p> <p style="text-align: center;">Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)</p>	<p style="text-align: center;">A.4.b.7</p> <p style="text-align: center;">A.4.b.7.a</p> <p style="text-align: center;">A.4.b.7.b</p> <p style="text-align: center;">A.4.b.7.c</p> <p style="text-align: center;">A.4.b.7.cbis</p> <p style="text-align: center;">A.4.b.7.d</p> <p style="text-align: center;">A.4.b.7.d.1</p> <p style="text-align: center;">A.4.b.7.d.2</p> <p style="text-align: center;">A.4.b.7.d.3</p> <p style="text-align: center;">...</p>	Radio astronomy
A.4.b.7	<p>For space stations operating in a frequency band subject to Nos. 22.5C, 22.5D or 22.5F, the data elements to characterize properly the performance of the non-geostationary-satellite system: to be provided, if A.4.b.6bis indicates the limited set of operating parameters</p>			
A.4.b.7.a	<p>the maximum number of non-geostationary satellites receiving simultaneously with overlapping frequencies from the associated earth stations within a given cell</p>		+	
A.4.b.7.b	<p>the average number of associated earth stations with overlapping frequencies per square kilometre within a cell</p>		+	
A.4.b.7.c	<p>the average distance, in kilometres, between co-frequency cells</p>		+	
A.4.b.7.cbis	<p>the minimum elevation angle at which any associated earth station can transmit to or receive from a non-geostationary satellite</p>		+	
A.4.b.7.d	<p>For the exclusion zone about the geostationary-satellite orbit:</p>			
A.4.b.7.d.1	<p>the type of zone (based on topocentric angle, satellite-based angle for establishing the exclusion zone)</p>		+	
A.4.b.7.d.2	<p>if the zone is based on a topocentric angle or a satellite-based angle, the width of the zone, in degrees</p>		+	
A.4.b.7.d.3	<p>Not used</p>			
...	<p style="text-align: center;">...</p>		...	

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary- satellite network	Advance publication of a non- geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non- geostationary-satellite network not subject to coordination under Section II of Article 9	Notification of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non- geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed- satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.14	FOR STATIONS OPERATING IN A FREQUENCY BAND SUBJECT TO Nos. 22.5C, 22.5D OR 22.5F: SPECTRUM MASKS										A.14	
A.14.a	For each e.i.r.p. mask used by the non-geostationary space station:										A.14.a	
A.14.a.1	the mask identification code					X					A.14.a.1	
A.14.a.2	the lowest frequency for which the mask is valid					X					A.14.a.2	
A.14.a.3	the highest frequency for which the mask is valid					X					A.14.a.3	
A.14.a.4	the mask pattern defined in terms of the power in the reference bandwidth for a series of angles measured at the non-geostationary space station between the line to the sub-satellite point and the line to a point on the geostationary arc, together with the bandwidth used					X					A.14.a.4	
A.14.a.5	the reference bandwidth used for the mask pattern of A.14.a.4					X					A.14.a.5	
A.14.b	For each associated earth station e.i.r.p. mask:										A.14.b	
A.14.b.1	the mask identification code					X					A.14.b.1	
A.14.b.2	the lowest frequency for which the mask is valid					X					A.14.b.2	
A.14.b.3	the highest frequency for which the mask is valid					X					A.14.b.3	
A.14.b.4	Not used										A.14.b.4	
A.14.b.5	Not used										A.14.b.5	

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.14.b.6	the mask pattern defined in terms of the power in the reference bandwidth as a function of latitude and the off-axis angle between the non-geostationary earth station boresight line and the line from the non-geostationary earth station to a point on the GSO arc					X					A.14.b.6	
A.14.b.7	the reference bandwidth used for the mask pattern of A.14.b.6					X					A.14.b.7	
A.14.c	For each pfd mask used by the non-geostationary space station: <i>Note</i> – The space station pfd mask is defined by the maximum power flux-density generated by any space station in the interfering non-geostationary-satellite system as seen from any point on the surface of the Earth										A.14.c	
A.14.c.1	the mask identification code					X					A.14.c.1	
A.14.c.2	the lowest frequency for which the mask is valid					X					A.14.c.2	
A.14.c.3	the highest frequency for which the mask is valid					X					A.14.c.3	
A.14.c.4	the type of mask, among one of the following types: (Earth-based exclusion zone angle, difference in longitude, latitude), (satellite-based exclusion zone angle, difference in longitude, latitude) or (satellite azimuth, satellite elevation, latitude)					X					A.14.c.4	
A.14.c.5	the mask pattern of the power flux-density defined in three dimensions					X					A.14.c.5	
A.14.c.6	the reference bandwidth used for the mask pattern of A.14.c.5					X					A.14.c.6	

Items in Appendix	A - GENERAL CHARACTERISTICS OF THE SATELLITE NETWORK, EARTH STATION OR RADIO ASTRONOMY STATION	Advance publication of a geostationary-satellite network	Advance publication of a non-geostationary-satellite network subject to coordination under Section II of Article 9	Advance publication of a non-geostationary-satellite network not subject to coordination under Section II of Article 9	Notification or coordination of a geostationary-satellite network (including space operation functions under Article 2A of Appendices 30 or 30A)	Notification or coordination of a non-geostationary-satellite network	Notification or coordination of an earth station (including notification under Appendices 30A or 30B)	Notice for a satellite network in the broadcasting-satellite service under Appendix 30 (Articles 4 and 5)	Notice for a satellite network (feeder-link) under Appendix 30A (Articles 4 and 5)	Notice for a satellite network in the fixed-satellite service under Appendix 30B (Articles 6 and 8)	Items in Appendix	Radio astronomy
A.14.d	<p>For each set of non-geostationary satellite system operating parameters to be provided, if A.4.b.6bis indicates the use of an extended set of operating parameters</p> <p><i>Note</i> – There could be different sets of parameters at different frequency bands, but only one set of operating parameters for any frequency band used by the non-geostationary system</p>										A.14.d	
A.14.d.1	the parameter set identification code					+					A.14.d.1	
A.14.d.2	the lowest frequency for which the mask is valid					+					A.14.d.2	
A.14.d.3	the highest frequency for which the mask is valid					+					A.14.d.3	
A.14.d.4	minimum limit of the latitude range of non-geostationary earth station locations in degrees North					+					A.14.d.4	
A.14.d.5	maximum limit of the latitude range of non-geostationary earth station locations in degrees North					+					A.14.d.5	
A.14.d.6	the average number of associated earth stations, per km ² , active at the same time					+					A.14.d.6	
A.14.d.7	the average distance, in kilometres, between co-frequency cell or beam footprint centre					+					A.14.d.7	
A.14.d.8	the minimum duration, in seconds, during which an earth station will track a non-geostationary satellite without handover for different ranges of latitude					+					A.14.d.8	
A.14.d.9	the maximum number of co-frequency tracked non-geostationary satellites for different ranges of latitude					+					A.14.d.9	