

IWG-3/037r7  
February 8, 2011

## United States of America

### DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

**Agenda item 1.25:** *to consider possible additional allocations to the mobile-satellite service in accordance with Resolution 231 (WRC-07);*

#### Background

Working Party 4C was the lead ITU-R Working Party for developing information related to Agenda Item 1.25 (WRC-12). It initiated this activity through a set of Liaison statements to other Working Parties requesting information on certain spectrum allocations of interest. The bands of interest were those which were potential candidates for additional mobile-satellite service (MSS) allocations.

Working Parties to which the liaisons were sent were those with services/bands that were of potential interest. The return Liaison Statements from the Working Parties included reference to various protection criteria and related ITU-R Recommendations. These were developed to provide for the sharing of the allocations by the services in the band whether of the same service or other services. Based on the responses from other Working Parties, WP 4C undertook sharing studies to determine if compatibility with the services already using the allocations could be achieved.

The Executive Summary of the draft CPM text for this agenda item indicates that studies of possible bands for new allocations to the MSS were developed in the (Earth-to-space) and (space-to-Earth) directions, with particular focus on the range 4-16 GHz, taking into account sharing and compatibility, without placing undue constraints on existing services in this band. Based on the results of studies, an appropriate amount of spectrum may be made available to the MSS systems in the 4-16 GHz range to overcome the shortfall of spectrum for the present and future MSS systems. The total requirements for the MSS in the 4-16 GHz range for the year 2020 are estimated to be between 240 and 335 MHz in each direction, and are contained in PDNRep ITU-R M.[MSS-REQS].

The Draft CPM text sets forth several Methods for each of the bands under consideration. The bands under consideration are indicated in the Table below. In general, the Methods of interest to the MSS proponents: Method A2, B2, C2, D2, E, F2, which provide for sharing with the incumbent services, are reflected in the proposals below.

<b>FREQUENCY BAND</b>	<b>MSS DIRECTION (DL = DOWNLINK) (UL = UPLINK)</b>
<b>5150-5250 MHZ</b>	<b>DL</b>
<b>7055-7250 MHZ</b>	<b>DL</b>
<b>8400-8500 MHZ</b>	<b>UL</b>

<b>10.5 - 10.6 GHZ</b>	<b>DL</b>
<b>13.25-13.4 GHZ</b>	<b>DL</b>
<b>15.43-15.63 GHZ</b>	<b>UL</b>

This document addresses a sub-set of the above frequency bands (7125-7250 MHz, 8400-8500 MHz, 10.5-10.55 GHz and 13.25-13.4 GHz). The other bands will be the subject of separate proposals.

### Proposals:

## ARTICLE 5

### Frequency allocations

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

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**MOD** USA/1.25/1

#### 5 570-7 250 MHz

Allocation to services		
Region 1	Region 2	Region 3
*****		
<b>6 700-7 075</b>	FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE 5.458 5.458A 5.458B 5.458C	
<b>7 075-7 125</b>	FIXED MOBILE 5.458 5.459	
<b>7 125-7 145</b>	FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.458 5.459 5.MSS	
<b>7 145-7 235</b>	FIXED MOBILE SPACE RESEARCH (Earth-to-space) 5.460 MOBILE-SATELLITE (space-to-Earth) 5.458 5.459 5.MSS 5.MSS1	
<b>7 235-7 250</b>	FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.458 5.MSS	

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**ADD** USA/1.25/2

**5.MSS** Use of the band 7 125-7 250 MHz by the mobile-satellite service is limited to geostationary satellite systems and is subject to application of No. **9.21**. The use of this band by the mobile-satellite service is subject to application of the provisions of No. **9.14**.

**Reason:** To allocate 7125-7250 MHz to MSS in the downlink direction limited to geostationary satellite systems and to apply coordination mechanisms.

**ADD** USA/1.25/3

**5.MSS1** In the band 7 145-7 235 MHz, Resolution [SRS-MSS] shall apply. In this band, earth stations in the mobile-satellite service shall not claim protection from current and future earth stations in the space research service.

**Reason:** To address sharing between MSS earth stations and SRS earth stations. Given the limited number and known locations of SRS earth stations, such an approach would still allow for feasible sharing with receiving GSO MSS earth stations.

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**MOD** USA/1.25/4

**7 250-8 500 MHz**

Allocation to services		
Region 1	Region 2	Region 3
* * * * *		
<b>8 400-8 500</b>	FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth) 5.465 5.466 <u>MOBILE-SATELLITE (Earth-to-space)</u> <u>5.MSS3</u>	
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**ADD** USA/1.25/5

**5.MSS3** Use of the bands 8 400-8 500 MHz by the mobile-satellite service is limited to geostationary satellite systems and is subject to application of No. **9.21**. Resolution [SRS-MSS2] shall apply.

**Reason:** To allocate 8400-8500 MHz to MSS in the uplink direction limited to geostationary satellite systems and to apply coordination mechanisms.

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**MOD** USA/1.25/6

**10-11.7 GHz**

Allocation to services		
Region 1	Region 2	Region 3
*****		
<b>10.5-10.55</b> FIXED MOBILE <u>MOBILE-SATELLITE (space-to-Earth)</u> Radiolocation <u>5.MSS4</u>	<b>10.5-10.55</b> FIXED MOBILE RADIOLOCATION <u>MOBILE-SATELLITE (space-to-Earth)</u> <u>5.MSS4</u>	
<b>10.55-10.6</b>	FIXED MOBILE except aeronautical mobile Radiolocation	
*****		

**ADD** USA/1.25/7

**5.MSS4** Use of the band 10.5-10.55 GHz by the mobile-satellite service is limited to geostationary satellite systems and is subject to application of the provisions of No. **9.14**.

**Reason:** To allocate 10.5-10.55 GHz to MSS in the downlink direction limited to geostationary satellite systems and to apply coordination mechanisms.

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**MOD** USA/1.25/8**11.7-14 GHz**

Allocation to services		
Region 1	Region 2	Region 3
*****		
<b>12.75-13.25</b>	FIXED FIXED-SATELLITE (Earth-to-space) 5.441 MOBILE Space research (deep space) (space-to-Earth)	
<b>13.25-13.4</b>	EARTH EXPLORATION-SATELLITE (active) AERONAUTICAL RADIONAVIGATION 5.497 SPACE RESEARCH (active) <u>MOBILE-SATELLITE (space-to-Earth)</u> 5.498A 5.499 <u>5.MSS5</u>	
<b>13.4-13.75</b>	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH 5.501A Standard frequency and time signal-satellite (Earth-to-space) 5.499 5.500 5.501 5.501B	

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**ADD** USA/1.25/9

**5.MSS5** Use of the band 13.25-13.4 GHz by the mobile-satellite service is limited to geostationary satellite systems and is subject to application of No. **9.21**. In order to protect systems in the Earth Exploration-Satellite Service (active), Space Research Service (active) and Aeronautical Radionavigation Service, the power flux density at the surface of the Earth from MSS space stations shall not exceed -115 dBW/m<sup>2</sup>/MHz for all angles of arrival.

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**Reason:** To allocate 13.25-13.4 GHz to MSS in the downlink direction limited to geostationary satellite systems and to apply coordination mechanisms and pfd limits to ensure compatibility with existing services in the 13 GHz band.

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**MOD** USA/1.25/10

**5.498A** The Earth Exploration-satellite (active), ~~space research~~ (active) and mobile-satellite services operating in the band 13.24-13.4 GHz shall not cause harmful interference to, or constrain the use and development of, the aeronautical radionavigation service (No. **4.10** applies).

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**Reason:** To apply a mechanism for providing protection to the aeronautical radionavigation service, by extending provisions that already exist.

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## ARTICLE 22

### Space services<sup>1</sup>

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**ADD** USA/1.25/11

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#### Section VII – Control of interference to space research service space stations

**22.40** In the frequency band 7 145-7 190 MHz, the maximum power flux-density produced at any point in deep space (space at distances from the Earth equal to, or greater than,  $2 \times 10^6$  km)

<sup>1</sup> **A.22.1** In applying the provisions of this Article, the level of accepted interference (see No. **1.168**) shall be fixed by agreement between the administrations concerned, using the relevant ITU-R Recommendations as a guide.

by a geostationary-satellite system in the mobile-satellite service shall not exceed  $-199.5$  dB(W/m<sup>2</sup>) in any 20 Hz band.

**Reason:** To apply provisions to ensure compatibility with SRS space stations operating in deep space.

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## APPENDIX 5 (Rev.WRC-07)

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

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MOD USA/1.25/12

TABLE 5-1 (continued) (WRC-12)

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Reference of Article 9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/condition	Calculation method	Remarks
No. 9.13 GSO/ non-GSO	A station in a GSO satellite network in the frequency bands for which a footnote refers to No. 9.11A or No. 9.13, in respect of any other non-GSO satellite network, with the exception of coordination between earth stations operating in the opposite direction of transmission	Frequency bands for which a footnote refers to No. 9.11A or No. 9.13	1) Bandwidths overlap 2) For the band 1 668-1 668.4 MHz with respect to MSS network coordination with <b>SRS</b> (passive) networks, in addition to bandwidth overlap, the e.i.r.p. spectral density of mobile earth stations in a GSO network of the mobile-satellite service operating in this band exceeds $-2.5$ dB(W/4 kHz) or the power spectral density delivered to the mobile earth station antenna exceeds $-10$ dB(W/4 kHz)	1) Check by using the assigned frequencies and bandwidths 2) Check by using MSS network Appendix 4 data	
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)	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 <sup>2</sup> · MHz)) for $0^\circ \leq \theta \leq 5^\circ$ $-124 + 0.5 (\theta - 5)$ dB(W/(m <sup>2</sup> · MHz)) for $5^\circ < \theta \leq 25^\circ$ $-114$ dB(W/(m <sup>2</sup> · MHz)) for $\theta > 25^\circ$ where $\theta$ is the angle of arrival of the incident wave above the horizontal plane (degrees)	1) See § 1 of Annex 1 to this Appendix	

		<p><u>3) 7 125-7250 MHz (GSO MSS)</u></p>	<p><u>3) In the band 7 125-7 250 MHz (GSO MSS):</u>  <u>-140 dB(W/(m<sup>2</sup> · MHz)) for 0° ≤ θ ≤ 5°</u>  <u>-140 + 5/3*(θ - 5) dB(W/(m<sup>2</sup> · MHz))</u>  <u>for 5° &lt; θ ≤ 20°</u>  <u>-115 dB(W/(m<sup>2</sup> · MHz)) for θ &gt; 20°</u>  <u>where θ is the angle of arrival of the incident wave above the horizontal plane (degrees)</u></p>		
		<p><u>4) 10.5-10.55 GHz (GSO MSS)</u></p>	<p><u>4) In the band 10.5-10.55 GHz (GSO MSS):</u>  <u>-140 dB(W/(m<sup>2</sup> · MHz)) for 0° ≤ θ ≤ 5°</u>  <u>-140 + 5/3*(θ - 5) dB(W/(m<sup>2</sup> · MHz))</u>  <u>for 5° &lt; θ ≤ 20°</u>  <u>-115 dB(W/(m<sup>2</sup> · MHz)) for θ &gt; 20°</u>  <u>where θ is the angle of arrival of the incident wave above the horizontal plane (degrees)</u></p>		

**Reason:** To apply provisions to protect terrestrial services operating in the 7125-7250 MHz band and the 10.5-10.55 GHz band.

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## APPENDIX 7 (Rev.WRC-07)

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MOD USA/1.25/13

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TABLE 7b (WRC-07)

**Parameters required for the determination of coordination distance for a transmitting earth station**

Transmitting space radiocommunication service designation		Fixed-satellite, mobile-satellite, meteorological-satellite		<u>Mobile-Satellite</u>	
Frequency bands (GHz)		7.900-8.400		<u>8.400-8.500</u>	
Receiving terrestrial service designations		Fixed, mobile		<u>Fixed, mobile</u>	
Method to be used		§ 2.1		<u>§ 1.4.6</u>	
Modulation at terrestrial station <sup>1</sup>		A	N	<u>A</u>	<u>N</u>
Terrestrial station interference parameters and criteria	$p_0$ (%)	0.01	0.005	<u>0.01</u>	<u>0.005</u>
	$n$	2	2	<u>1</u>	<u>1</u>
	$p$ (%)	0.005	0.0025	<u>0.01</u>	<u>0.005</u>
	$N_L$ (dB)	0	0	<u>0</u>	<u>0</u>
	$M_s$ (dB)	33	37	<u>33</u>	<u>37</u>
	$W$ (dB)	0	0	<u>0</u>	<u>0</u>
Terrestrial station parameters	$G_x$ (dBi) <sup>4</sup>	46	46	<u>46</u>	<u>49</u>
	$T_e$ (K)	750	750	<u>750</u>	<u>575</u>
Reference bandwidth	$B$ (Hz)	$4 \times 10^3$	$10^6$	<u><math>4 \times 10^3</math></u>	<u><math>10^6</math></u>
Permissible interference power	$P_f(p)$ (dBW) in $B$	-131	-103	<u>-131</u>	<u>-141</u>

**Reason:** To apply provisions to allow administrations to coordinate stations located on their territory in order to ensure compatibility.

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MOD USA/1.25/14

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TABLE 8c

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

Receiving space radiocommunication service designation	Fixed-satellite		<u>Mobile-satellite</u>		Fixed-satellite		<u>Mobile-satellite</u>		<u>Mobile-satellite</u>		Fixed-satellite		<u>Mobile-satellite</u>			
Frequency bands (GHz)	6.700-7.075		<u>7.125-7.250</u>		7.250-7.750		<u>10.5-10.55</u>		<u>10.5-10.55</u>		10.7-12.75		<u>13.25-13.4</u>			
Transmitting terrestrial service designations	Fixed, mobile		<u>Fixed, mobile</u>		Fixed, mobile		<u>Fixed, mobile</u>		<u>Radiolocation</u>		Fixed, mobile		<u>Fixed</u>			
Method to be used	§ 2.2		<u>§ 1.4.6</u>		§ 2.1		<u>§ 1.4.6</u>		<u>§ 1.4.6</u>		§ 2.1, § 2.2		<u>§ 1.4.6</u>			
Modulation at earth station <sup>1</sup>	N		<u>N</u>		A N		<u>N</u>		<u>N</u>		A N		<u>N</u>			
Earth station interference parameters and criteria	$P_0$ (%)	0.005		<u>20</u>		0.03		0.005		<u>20</u>		<u>20</u>		0.03 0.003 <u>20</u>		
	$n$	3		<u>1</u>		3 3		<u>1</u>		<u>1</u>		2 2		<u>1</u>		
	$p$ (%)	0.0017		<u>20</u>		0.01 0.0017		<u>20</u>		<u>20</u>		0.015 0.0015		<u>20</u>		
	$N_L$ (dB)	1		<u>1</u>		1 1		<u>1</u>		<u>1</u>		1 1		<u>1</u>		
	$M_s$ (dB)	2		<u>0.254</u>		7 2		<u>0.254</u>		<u>0.254</u>		7 4		<u>0.254</u>		
	$W$ (dB)	0		<u>0</u>		4 0		<u>0</u>		<u>0</u>		4 0		<u>0</u>		
Terrestrial station parameters	$E$ (dBW) in $B^2$	A	55		<u>45</u>		55 55		<u>37</u>		<u>44</u>		40 40 <u>30</u>			
		N	42		<u>32</u>		42 42		<u>33</u>		-		43 43 <u>33</u>			
	$P_r$ (dBW) in $B$	A	13		<u>3</u>		13 13		<u>-4</u>		<u>4</u>		-5 -5 <u>-15</u>			
		N	0		<u>-10</u>		0 0		<u>-12</u>		-		-2 -2 <u>-13</u>			
$G_x$ (dBi)	42		<u>42</u>		42 42				<u>40</u>		45 45		<u>45</u>			
Reference bandwidth <sup>6</sup>	$B$ (Hz)		10 <sup>6</sup>		<u>10<sup>5</sup></u>		10 <sup>6</sup> 10 <sup>6</sup>		<u>10<sup>5</sup></u>		<u>10<sup>5</sup></u>		10 <sup>6</sup> 10 <sup>6</sup> <u>10<sup>5</sup></u>			
Permissible interference power	$P_r(p)$ (dBW) in $B$		-151.2		<u>-163.8</u>				<u>-163.8</u>		<u>-163.8</u>				<u>-163.8</u>	

**Reason:** To apply provisions to allow administrations to coordinate stations located on their territory in order to ensure compatibility.

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TABLE 10 (WRC-07)

Predetermined coordination distances

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Frequency sharing situation		Coordination distance (in sharing situations involving services allocated with equal rights) (km)
Type of earth station	Type of terrestrial station	
Ground-based in the bands below 1 GHz to which No. 9.11A applies. Ground-based mobile in the bands within the range 1-3 GHz to which No. 9.11A applies	Mobile (aircraft)	500
Aircraft (mobile) (all bands)	Ground-based	500
Aircraft (mobile) (all bands)	Mobile (aircraft)	1 000
Ground-based in the bands: 400.15-401 MHz 1 668.4-1 675 MHz	Station in the meteorological aids service (radiosonde)	580
Aircraft (mobile) in the bands: 400.15-401 MHz 1 668.4-1 675 MHz	Station in the meteorological aids service (radiosonde)	1 080
Ground-based in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	100
Airborne earth station in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	400
Receiving earth stations in the meteorological-satellite service	Station in the meteorological aids service	The coordination distance is considered to be the visibility distance as a function of the earth station horizon elevation angle for a radiosonde at an altitude of 20 km above mean sea level, assuming 4/3 Earth radius (see Note 1)
Non-GSO MSS feeder-link earth stations (all bands)	Mobile (aircraft)	500
Ground-based in the bands in which the frequency sharing situation is not covered in the rows above	Mobile (aircraft)	500
<del>Ground-based MSS in 13.25-13.4 GHz</del>	<del>Mobile (ARNS)</del>	<del>500</del>

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NOTE 1 – The coordination distance,  $d$  (km), for fixed earth stations in the meteorological-satellite service vis-à-vis stations in the meteorological aids service assumes a radiosonde altitude of 20 km and is determined as a function of the physical horizon elevation angle  $\epsilon_h$  (degrees) for each azimuth, as follows:

$$d = 100 \quad \text{for} \quad \epsilon_h \geq 11^\circ$$

$$d = 582 \left( \sqrt{1 + (0.254 \epsilon_h)^2} - 0.254 \epsilon_h \right) \quad \text{for} \quad 0^\circ < \epsilon_h < 11^\circ$$

$$d = 582 \quad \text{for} \quad \epsilon_h \leq 0^\circ$$

The minimum and maximum coordination distances are 100 km and 582 km, and correspond to physical horizon angles greater than  $11^\circ$  and less than  $0^\circ$ . (WRC-2000)

**Reason:** To apply provisions to allow administrations to coordinate stations located on their territory in order to ensure compatibility.

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**ADD** USA/1.25/16

### **RESOLUTION [SRS-MSS] (WRC-12)**

#### **Provisions for operational coordination of mobile-satellite service space stations with space research service space stations during periods of operation at less than $2 \times 10^6$ km from the Earth in the band 7 145-7 235 MHz**

The World Radiocommunication Conference (Geneva) 2012,

*considering*

- a) that the band 7 145-7 235 MHz is allocated to the space research service (Earth-to-space), the fixed service and the mobile service;
- b) that WRC-12 added an allocation in the band 7 145-7 235 MHz to the mobile-satellite service (MSS) in the space-to-Earth direction limited to geostationary satellite orbit systems (GSO);
- c) that No. **5.460** provides that use of the band 7 145-7 190 MHz by the space research service (Earth-to-space) is restricted to deep space;
- d) that deep space missions include critical near Earth phases such as launch and early operation phases, Earth fly-bys or sample returns where the mission operates at less than  $2 \times 10^6$  km from the Earth and thus it may suffer harmful interference from the transmissions of GSO MSS space stations;
- e) that these near earth phases of deep space missions occur infrequently and for limited durations of time;
- f) that deep space transmissions in the band 7 145-7 190 MHz during near Earth phases occur in predetermined frequencies at predictable times, except in cases of spacecraft emergency or anomaly;
- g) that the MSS operator can control the timing of its transmissions in the space-to-Earth direction in particular frequencies;
- h) that the 7 190-7 235 MHz band is used by near Earth SRS systems, which operate at less than  $2 \times 10^6$  km from the Earth;
- i) that the near Earth SRS space stations could employ orbits where harmful interference could be received from GSO MSS space stations;

- j) that the near Earth SRS space stations in the 7 190-7 235 MHz band have predictable orbits and transmit in predetermined channels;
- k) that there are likely to be a limited number of operational GSO MSS satellite systems due to necessary orbital separations to avoid interference to small MSS earth stations;
- l) that the launch phases of SRS missions are often affected by weather conditions or technical factors and can change on very short notice,

*recognizing*

- a) that Article 9 has provisions applicable to coordination between satellite systems and networks operating in the same band;
- b) that the provisions in Article 9 are not sufficient for addressing the relatively short term and infrequent nature of the interference situations described in *considerings d), e) and i)* above,

*resolves*

- 1) that under the provisions of Annex 1 to this Resolution, notifying administrations for MSS networks shall ensure that the operator of a MSS network shall coordinate its operations in the 7 145-7 190 MHz band with the operators of deep space SRS systems and shall coordinate its operations in the 7 190-7 235 MHz band with the operators of near earth SRS systems;
- 2) that when, as a result of *resolves 1)*, information of anticipated deep space SRS transmissions are provided to the operators of MSS networks in accordance with Annex 1, notifying administrations for MSS networks shall ensure that the MSS network operators will effect the cessation of MSS space station transmissions during the time and in the frequency range, as determined by the SRS mission operators, where harmful interference could be caused to the SRS mission.
- 3) that MSS space stations planned to operate in the 7145-7235 MHz band shall be designed so that their operation on a subset of frequencies within the band can be shut off by ground command when required to comply with this Resolution.

**Annex 1 to Resolution [SRS-MSS]**

**Procedures for operational coordination of mobile-satellite service space stations with space research service space stations during periods of operation at less than 2 x 10<sup>6</sup> km from the Earth in the band 7 145-7 235 MHz**

- 1) The notifying administration for MSS systems in this band shall ensure that such systems follow the provisions of this Annex in order to protect from harmful interference SRS space stations of potentially concerned administrations.
- 2) The potentially concerned administrations referred to in the previous item 1) are those who have submitted advance publication information for systems in the space research service in the band 7 145-7 235 MHz.
- 3) Administrations who have submitted the advance publication information in previous item 2) shall maintain a list of contact points for operational coordination of their SRS systems under this Resolution.
- 4) Administrations referred to in previous item 3) shall provide this contact information to the Bureau for maintenance in a list of SRS contact points under this Resolution. The contact information shall include names, addresses, email addresses and telephone numbers. The Bureau shall maintain the list of contact information on its website.
- 5) [One year] prior to launch of an MSS system, the MSS system operator shall provide the name, address, email address and telephone number for its contact point for operational coordination to the SRS contact points on the Bureau's website.
- 6) [One year] prior to launch of an MSS system, the MSS system operator shall provide information on the frequency plan, coverage area and other relevant technical details on its satellite system to the list of SRS contact points. This information may be supplied by referencing the associated coordination request publication, or by providing additional information, as deemed most appropriate by the MSS system operator.
- 7) The SRS system operators shall analyze this information and use it to determine when one of their near Earth operations as described in *considerings d) and h)* of this Resolution might receive harmful interference from MSS downlink transmissions.
- 8) With respect to near Earth phase operations of a deep space mission as described in *considering d)*:
  - a) As early as possible but not less than [60] days prior to a planned near Earth phase operation of a deep space mission, the SRS system operator shall provide the details as described in Annex 2 of the requirement for MSS interruption of transmissions including dates, times and frequencies to be avoided by the MSS system.
  - b) The MSS system operator, having received this information, shall not operate on the affected frequency range during the requested time period.
  - c) Changes in launch plans or flight plans may occur on shorter notice than envisioned in *a)* and *b)* above. Both parties agree to react quickly and responsively in the case of such changes. The parties shall work together

to define a process to accommodate a change in the timing of the required MSS shut off period.

9) With respect to near Earth satellite network as described in *considerings h) and i)* of this Resolution:

a) For SRS networks not yet in operation

As early as possible but not less than [180] days prior to the anticipated beginning of operation of a near Earth satellite network that the SRS operator believes may receive harmful interference from MSS satellite networks based on its analysis under previous item 7), the SRS system operator shall provide the details as described in Annex of its analysis to the MSS system operators using the contact information provided under previous item 5). The two operators shall work together to reach a solution where the MSS system does not cause harmful interference to the SRS near Earth satellite network. Until successful coordination is reached, the MSS system operator shall not operate simultaneously with the potentially affected SRS satellite network on any of the frequencies identified by the SRS system operator.

b) For operational SRS networks

If the SRS operator believes its network may receive harmful interference from MSS satellite networks based on its analysis under previous item 7), the SRS system operator shall provide as early as possible the details as described in Annex 2 of its analysis. The two operators shall work together to reach a solution where the MSS system does not cause harmful interference to the SRS near Earth satellite network. Until successful coordination is reached, the MSS system operator shall not operate simultaneously with the potentially affected SRS satellite network on any of the frequencies identified by the SRS system operator.

10) The parties involved in a near Earth coordination under this Resolution shall cooperate to the maximum extent possible to minimize the constraints on both parties.

#### **Annex 2 to Resolution [SRS-MSS]**

#### **Information on near Earth phases of deep space missions or near Earth missions to be provided to MSS operators**

Information related to near Earth phases of deep space SRS missions

If the SRS operator determines that a MSS satellite network may cause harmful interference to a near Earth phase of a deep space mission, the SRS operator shall provide to the operator of the MSS satellite network the following information:

- a) The beginning and end of the duration of the time slots during which the affecting MSS transmissions should be discontinued. The dates and times defining these time slots shall be referred to GMT;
- b) The respective lower and upper frequency boundaries of the frequency slots where the transmissions referred to above should be discontinued; and
- c) The basis for the foreseen interference.

#### Information related to near Earth SRS satellite networks

When responding under item 8) of Annex 1 to this Resolution, the following information shall be provided to the MSS operator by the SRS operator:

- a) orbit characteristics of the SRS satellite network;
- b) 360° gain pattern of the SRS space station receive antenna(s);
- c) assumed interference e.i.r.p. density allowed at the SRS space station receiver input;
- d) frequency plan of the SRS satellite network; and
- e) if not yet in operation, date and time when the affected SRS operations will begin.

**Reason:** To provide provisions for operational coordination of GSO MSS systems with SRS systems for the limited periods in time when SRS space stations will operate near the Earth.

\* \* \* \* \*

**ADD** USA/1.25/17

### **RESOLUTION [SRS-MSS2] (WRC-12)**

#### **Provisions for coordination of stations in the mobile-satellite service with space research systems in the band 8 400-8 500 MHz**

The World Radiocommunication Conference (Geneva 2012),

*considering*

- a) that the band 8 400-8 500 MHz is allocated to the space research service (space-to-Earth), the fixed service and the mobile service;
- b) that No. **5.465** provides that use of the band 8 400-8 450 MHz by the space research service (space-to-Earth) is limited to deep space;
- c) that WRC-12 added an allocation in the band 8 400-8 500 MHz to the mobile-satellite service (MSS) in the Earth-to-space direction limited to geostationary satellite orbit systems (GSO);
- d) that deep space missions include very critical near Earth phases such as launch and early operation phases, Earth fly-bys or sample returns, where the mission's orbit may be such that it may cause harmful interference to GSO MSS space stations;
- e) that these near earth phases of deep space missions occur infrequently and for limited durations of time;
- f) that deep space transmissions in the band 8 400-8 450 MHz occur in predetermined frequencies at predetermined times, except in cases of spacecraft emergency or anomaly;
- g) that the 8 450-8 500 MHz band is used by near Earth SRS systems, which operate at less than  $2 \times 10^6$  km from the Earth;
- h) that the near Earth SRS space stations could employ orbits where interference could be caused to receiving MSS space stations;
- i) that the near Earth SRS space stations in the 8 450-8 500 MHz band have predictable orbits and transmit in predetermined channels;
- j) that there are likely to be a limited number of GSO MSS satellite networks due to necessary orbital separations to avoid interference to small MSS earth stations;
- k) that the information on channel, launch, orbit and transmissions of SRS operating in the 8 400-8 500 MHz band is predictable;
- l) that the launch phases of SRS missions are often affected by weather conditions or technical factors and can change on very short notice,
- m) that SRS earth stations require protection in the band 8 400-8 500 MHz, and that such protection can be achieved through requiring that MSS earth stations observe certain separation distances;
- n) that the GSO MSS earth station separation distances referenced in *considering l)* depend on the azimuth angles in the direction of the SRS station, as well as the antenna pointing accuracy, antenna patterns and resolution of terrain data;

o) that technology exists for MSS earth stations to implement such separation distances, for example, by using the geo-location facility that already exists in most MSS earth stations to determine the earth station's location and signal this information to the MSS control facility, which will prohibit the MSS earth station from transmitting on the necessary frequencies if the MES is located in an exclusion area;

*recognizing*

a) that Article 9 has provisions applicable to coordination between satellite systems and networks operating in the same band;

b) that the provisions in Article 9 are not sufficient for addressing the relatively short term and infrequent nature of the interference situations described in *considerings d), e) and h)* above,

c) that, without establishment of enforceable exclusion zones, MSS earth stations could place an extra burden on SRS systems in the band 8 400-8 500 MHz;

*resolves*

1) that the notifying administration of an MSS network shall ensure that the operator of a MSS network shall coordinate its operations in the 8 400-8 500 MHz band with the operators of SRS systems under the provisions of Annex 1 to this Resolution;

2) [that MSS earth stations operating in the band 8 400-8 500 MHz shall track the MSS satellite to facilitate protection of SRS earth stations regardless of location;]

3) that the notifying administration of an MSS network shall ensure that MSS network operators shall ensure that MSS earth stations communicating with its network observe the exclusion zones established in accordance with Annex through the incorporation of software in the MSS system that will ensure cessation of transmissions in the exclusion zones near SRS earth stations;

### **Annex 1 to Resolution [SRS-MSS2]**

#### **Procedures for operational coordination of mobile-satellite service space stations with space research service space stations in the band 8 400-8 500 MHz**

1) The notifying administration for MSS systems in this band shall ensure that such systems follow the provisions of this Annex.

2) The potentially concerned SRS administrations are those submitting advance publication information for systems in the space research service in the band 8 400-8 500 MHz.

- 3) Administrations submitting the advance publication information in previous item 2) shall maintain a list of contact points for operational coordination of its SRS systems under this Resolution.
- 4) Administrations referred to in previous item 3) shall provide this contact information to the Bureau for maintenance in a list of SRS contact points under this Resolution. The contact information shall include names, addresses, email addresses and telephone numbers. The Bureau shall maintain the list of contact information on its website.
- 5) [One year] prior to launch of an MSS system, the MSS system operator shall provide the name, address, email address and telephone number for its contact point for operation coordination to the SRS contact points on the Bureau's website.
- 6) [One year] prior to launch of an MSS system, the MSS system operator shall provide information on the frequency plan, coverage area and other relevant technical details on its satellite system to the list of SRS contact points. This information may be supplied by referencing the associated coordination request publication, or by providing additional information.
- 7) With respect to near Earth phase operations of a deep space mission:
  - a) As early as possible but not less than [60] days prior to a planned near Earth phase operation of a deep space mission, the SRS system operator shall provide the details of its planned operations (as described in Annex 2) to the corresponding MSS system operators using the contact information provided under previous item 5).
  - b) The MSS system operator, having received this information, will determine if further consultation is required in order for the MSS satellite operator to have sufficient information to take measures to protect itself from interference. Should any consultation be required, the MSS system operator shall inform the SRS system operator as soon as possible but at least within [30] days of receiving the notification.
  - c) Changes in launch plans or flight plans may occur on shorter notice than envisioned in *a)* and *b)* above. Both parties agree to react quickly and responsively in the case of such changes. The parties shall work together to define a process to accommodate a change in the timing of potential interference to the MSS system.
- 8) With respect to near Earth satellite networks:
  - a) At the request of the MSS operator, the SRS system operators shall provide, within 30 days of such request, information on actual space-to-Earth transmission characteristics of their near-Earth satellite networks. The list of characteristics to be provided is defined in Annex 2.

- b) The MSS system operator, having received this information, will determine if further consultation is required in order for the MSS satellite operator to have sufficient information to take measures to protect itself from interference. Should any consultation be required, the MSS system operator shall inform the SRS system operator as soon as possible but at least within [30] days of receiving the notification.
- 9) The parties involved in a near Earth coordination (i.e., coordination of a near Earth phase of a deep space mission or coordination of a near Earth satellite system) shall cooperate to the maximum extent possible to minimize the constraints on both parties.

## **Annex 2 to Resolution [SRS-MSS2]**

### **Information on near Earth phases of deep space missions to be provided to MSS operators**

#### Information related to near Earth phases of deep space SRS missions

The SRS system operators shall provide to the potentially affected MSS operator the following information:

- a) The beginning and end of the duration of the time slots during which the MSS space station may receive interference. The dates and times defining these time slots shall be referred to GMT; and
- b) The respective lower and upper frequency boundaries of the frequency slots where the transmissions referred to above will take place;

#### Information related to near Earth SRS satellite networks

SRS system operators shall provide to the MSS operators, upon request, the following information:

- a) orbit characteristics of the SRS satellite network;
- b) 360° gain pattern of the SRS space station transmit antenna(s);
- c) power density levels delivered to the SRS space station transmit antenna(s);
- d) frequency plan of the SRS satellite network; and
- e) if not yet in operation, date and time when the SRS operations will begin.

### **Annex 3 to Resolution [SRS-MSS2]**

#### **Definition of and implementation of exclusion zones where operation of MSS earth stations is not permitted around SRS earth stations**

Exclusion zones wherein transmissions from MSS Earth stations in the 8 400 – 8 500 MHz frequency band are not allowed shall be established around existing and/or planned SRS Earth stations for each potentially affecting MSS satellite network.

a) Exclusion zones for protection of SRS Earth stations operating in the 8 400 – 8 450 MHz band

Exclusion zones to protect SRS Earth stations operating with deep space missions shall be established for each MSS satellite network in accordance with the following procedure:

For each azimuth in  $[X]^{\circ}$  steps around an SRS Earth station registered with the ITU for operations in the frequency band 8 400 – 8450 MHz, the minimum angle between the direction of an MSS Earth station transmit antenna main beam, assumed to be pointing towards the MSS satellite with which it is communicating, and the direction of the SRS Earth station, shall be determined, taking into account the MSS satellite orbital location and station keeping tolerance, and the MSS antenna worst case pointing accuracy.

For each type of MSS Earth station, the sum of the maximum possible power density delivered to its transmit antenna and the respective transmit antenna gain calculated for the minimum off-axis angle determined above shall be determined. This is the value of the maximum off-axis e.i.r.p. density that may be radiated towards the SRS Earth station for that azimuth and for that type of Earth station of that specific MSS satellite network.

The maximum of all values of off-axis e.i.r.p. density that may be radiated towards the SRS Earth station for each azimuth around the SRS Earth station and for all types of Earth stations of that specific MSS satellite network shall then be determined.

The required separation distance for each azimuth around the SRS Earth station shall be the distance required to reduce the maximum e.i.r.p. density that may be radiated towards the SRS Earth station, determined by the above procedure, to -173.5 dBW/MHz for all but 0.001% of the time, using the procedure indicated in Recommendation ITU-R P. 452.

b) Exclusion zones for protection of SRS Earth stations operating in the 8 450 – 8 500 MHz band

Exclusion zones to protect SRS Earth stations operating with near Earth missions shall be established for each MSS satellite network in accordance with the following procedure:

For each azimuth in  $[X]^\circ$  steps around an SRS Earth station registered with the ITU for operations in the frequency band 8 450 – 8500 MHz, the minimum angle between the direction of an MSS Earth station transmit antenna main beam, assumed to be pointing towards the MSS satellite with which it is communicating, and the direction of the SRS Earth station, shall be determined, taking into account the MSS satellite orbital location and station keeping tolerance, and the MSS antenna worst case pointing accuracy.

For each type of MSS Earth station, the sum of the maximum possible power density delivered to its transmit antenna and the respective transmit antenna gain calculated for the minimum off-axis angle determined above shall be determined. This is the value of the maximum off-axis e.i.r.p. density that may be radiated towards the SRS Earth station for that azimuth and for that type of Earth station of that specific MSS satellite network.

The maximum of all values of off-axis e.i.r.p. density that may be radiated towards the SRS Earth station for each azimuth around the SRS Earth station and for all types of Earth stations of that specific MSS satellite network shall then be determined.

The required separation distance for each azimuth around the SRS Earth station shall be the distance required to reduce the maximum e.i.r.p. density that may be radiated towards the SRS Earth station, determined by the above procedure, to -170.5 dBW/MHz for all but 0.1% of the time, using the procedure indicated in Recommendation ITU-R P. 452.

No MSS transmissions shall be allowed within the exclusion zones established according to a) and b) above for that particular MSS satellite network around the potentially affected SRS Earth stations as long as the SRS Earth stations remain operational.

Whenever additional SRS Earth stations which may be affected by the MSS satellite networks operating in the 8 400 – 8 500 MHz frequency band are registered with the ITU, the relevant exclusion zones shall be developed by the affecting MSS operators. Any potentially affecting MSS transmission within the respective exclusion zone shall cease as soon as the new SRS Earth station becomes operational, and shall not be allowed as long as the potentially affected SRS Earth stations remain operational.

**Reason:** To provide provisions for coordination of GSO MSS stations with SRS stations, including application of exclusion zones around receiving SRS earth stations.

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