

## 2015 WORLD RADIOCOMMUNICATION CONFERENCE

### DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

**AGENDA ITEM 1.6.2** *To consider possible additional primary allocations to the fixed-satellite service (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13-17 GHz; and review the regulatory provisions on the current allocations to the fixed-satellite service within each range, taking into account the results of ITU R studies, in accordance with Resolution 151 (WRC 12)*

#### **BACKGROUND:**

This agenda item studies the unplanned fixed-satellite service (FSS) imbalance in the Earth-to-space direction within ITU Regions 2 and 3 and considers allocating an additional 250 MHz and 300 MHz FSS (Earth-to-space), within the range 13.0-17.0 GHz, in Region 2 and Region 3, respectively. ITU-R sharing studies for this agenda item shall exclude the frequency band 13.0-13.25 GHz from consideration, in accordance with resolves 3 of Resolution **152 (WRC-12)**. As a result, studies in the ITU-R must demonstrate compatibility with incumbent services prior to WRC-15 allocating any additional spectrum to the FSS (Earth-to-space) in the range 13.25-17.0 GHz.

The existing unplanned FSS bands in this frequency range are extensively used for a myriad of applications. The very small aperture terminal (VSAT) services, video distribution, broadband networks, internet services, satellite newsgathering, and backhaul links have triggered the rapid rise in the demand. Satellite traffic is typically symmetrical in a large variety of applications, i.e. similar amounts of Earth-to-space (uplink) and space-to-Earth (downlink) traffic are transmitted. However, in ITU Regions 2 and 3, there are asymmetrical Earth-to-space and space-to-Earth FSS allocations that are used for these services.

The 250 MHz spectrum asymmetry in Region 2 and 300 MHz in Region 3 translates to approximately 10 and 14 transponders for each respective Region, considering a transponder bandwidth of 36 MHz in both polarizations. Some satellite networks are designed with an additional uplink beam which has sufficient geographical isolation with the uplink beam within the intended service area. The satellites currently deployed have been registered in all of the available non-planned bands in Regions 2 and 3, both in the uplink and the downlink. Faced with the current congestion and spectrum asymmetry, it is challenging for satellite operators to effectively expand their communication services within this frequency range to meet the growing market demands.

In order to address this spectrum shortage and imbalance, WRC-12 adopted agenda item 1.6.2 to consider additional primary allocations to the fixed-satellite service in the range 13-17 GHz and review regulatory provisions for existing FSS allocations, taking into account ITU-R studies in accordance with Resolution **152 (WRC-12)**. Resolution **152 (WRC-12)** invites the ITU-R to complete, for WRC-15, sharing and compatibility studies towards additional allocations to the fixed-satellite service in the Earth-to-space direction of 250 MHz in Region 2 and 300 MHz in Region 3 within the band 13-17 GHz, focusing on the

frequency range that is contiguous (or near contiguous) to the existing fixed satellite service allocations, while protecting existing primary services within these bands. This Resolution also calls for studies considering utilization of existing allocations to the FSS in the Earth-to-space direction through a review of regulatory provisions, except for Nos. **5.502** and **5.503** and Resolution **144 (Rev. WRC-07)**.

Within portions of the band 13-17 GHz are primary allocations to the fixed, mobile, mobile except aeronautical mobile, radiolocation, Earth exploration-satellite (active), Earth exploration-satellite (passive), fixed-satellite (Earth-to-space), radio astronomy, space research, space research (passive), radionavigation, and aeronautical radionavigation services. In accordance with Resolution **152 (WRC-12)**, the ITU-R should conduct sharing studies to address the protection of existing in-band primary services and compatibility studies to address interference.

Studies carried out in preparation for WRC-95 identified limited sharing compatibility between FSS uplinks and space-borne active sensors in the Earth exploration-satellite service (active) operating in the band 13.75-14.0 GHz. In the Table of Allocations there are no instances where EESS (active) and FSS (Earth-to-space) are co-primary.

The United States also maintains extensive mobile service operations in the band 14.5-15.35 GHz, which will require in-depth study with the proposed FSS operations. As noted in Resolution **152 (WRC-12)**, *further recognizing e*, the band 15.35-15.4 GHz is allocated to passive services and No. **5.340** applies.

Working Party 4A is developing a Preliminary Draft New Report **ITU-R S.[R2R3.FSS]** to establish the issues and difficulties associated with this shortfall. This draft Report provides a framework for further work on the associated analyses and sharing studies in support of this agenda item.

**ISSUE:** This agenda item invites the ITU-R to conduct appropriate technical and regulatory studies to identify solutions to address the imbalance of uplink and downlink FSS spectrum within the band 13-17 GHz in accordance with Resolution **152 (WRC-12)** while protect existing primary services and the integrity off the frequency bands subject to a Plan. This proposal addresses the frequency band 14.5-15.35 GHz.

## **PROPOSAL:**

### ARTICLE 5

#### FREQUENCY ALLOCATIONS

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

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14-15.4 GHz

Allocation to services		
Region 1	Region 2	Region 3
<b>14-14.25</b>	FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.504C 5.506A Space research 5.504A 5.505	
<b>14.25-14.3</b>	FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.508A Space research 5.504A 5.505 5.508	
<b>14.3-14.4</b> FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A	<b>14.3-14.4</b> FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.506 5.506B Mobile-satellite (Earth-to-space) 5.506A Radionavigation-satellite  5.504A	<b>14.3-14.4</b> FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A
<b>14.4-14.47</b>	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Space research (space-to-Earth) 5.504A	
<b>14.47-14.5</b>	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radio astronomy 5.149 5.504A	
<b>14.5-14.8</b>	FIXED FIXED-SATELLITE (Earth-to-space) 5.510 <u>5.FSSA</u> MOBILE Space research	
<b>14.8-15.35</b>	FIXED MOBILE <u>FIXED-SATELLITE (Earth-to-space) 5.FSSA</u> Space research 5.339	

15.35-15.4

EARTH EXPLORATION-SATELLITE (passive)  
RADIO ASTRONOMY  
SPACE RESEARCH (passive)  
5.340 5.511

**Reasons:** to add a fixed-satellite service allocation to 14.8-15.35 GHz in order to alleviate the spectrum imbalance and allow full use of the downlink fixed-satellite service spectrum in 10.7-12.7 GHz.

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**5.510** The use of the band 14.5-14.8 GHz by the fixed-satellite service (Earth-to-space) for feeder links for the broadcasting-satellite service is governed by Appendix 30A. This use is reserved for countries outside Europe.

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**Reasons:** to clarify which uses of 14.5-14.8 GHz are governed by Appendix 30A.

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**5.FSSA** For other uses of the band 14.5-14.8 GHz by the fixed-satellite service (Earth-to-space) not covered by No. 5.510, the fixed-satellite service earth stations shall have a minimum earth station diameter of 1.2 meters.

**Reasons:** to include limitations on use of the 14.5-14.8 GHz by non-BSS feeder links in order to facilitate sharing with the mobile and fixed services.

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APPENDIX 7 (Rev.WRC-15)

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TABLE 7b (Rev.WRC-12)

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

Transmitting space radiocommunication service designation	Fixed-satellite, mobile-satellite	Aero-nautical mobile-satellite (R) service	Aero-nautical mobile-satellite (R) service	Fixed-satellite	Fixed-satellite	Fixed-satellite	Fixed-satellite	Space operation, space research	Fixed-satellite, mobile-satellite, meteorological-satellite	Fixed-satellite	Fixed-satellite	Fixed-satellite	Fixed-satellite <sup>3</sup>	Fixed-satellite	Fixed-satellite <sup>3</sup>						
Frequency bands (GHz)	2.655-2.690	5.030-5.091	5.030-5.091	5.091-5.150	5.091-5.150	5.725-5.850	5.725-7.075	7.100-7.235 <sup>5</sup>	7.900-8.400	10.7-11.7	12.5-15.3 <del>5</del>	13.75-14.3	15.43-15.65	17.7-18.4	19.3-19.7						
Receiving terrestrial service designations	Fixed, mobile	Aeronautical radio-navigation	Aeronautical mobile (R)	Aeronautical radio-navigation	Aeronautical mobile (R)	Radiolocation	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Fixed, mobile	Radiolocation radionavigation (land only)	Aeronautical radionavigation	Fixed, mobile	Fixed, mobile						
Method to be used	§ 2.1	§ 2.1, § 2.2	§ 2.1, § 2.2			§ 2.1	§ 2.1	§ 2.1, § 2.2	§ 2.1	§ 2.1	§ 2.1, § 2.2	§ 2.1		§ 2.1, § 2.2	§ 2.2						
Modulation at terrestrial station <sup>1</sup>	A					A	N	A	N	A	N	A	N	A	N		N	N			
Terrestrial station interference parameters and criteria	$P_0$ (%)	0.01						0.01	0.005	0.01	0.005	0.01	0.005	0.01	0.005	0.01		0.005	0.005		
	$N$	2						2	2	2	2	2	2	2	2	2		2	2		
	$p$ (%)	0.005						0.005	0.0025	0.005	0.0025	0.005	0.0025	0.005	0.0025	0.01		0.0025	0.0025		
	$N_L$ (dB)	0						0	0	0	0	0	0	0	0	0		0	0		
	$M_S$ (dB)	26 <sup>2</sup>						33	37	33	37	33	37	33	40	33	40	1	25	25	
$W$ (dB)	0						0	0	0	0	0	0	0	0	0	0		0	0		
Terrestrial station parameters	$G_x$ (dBi) <sup>4</sup>	49 <sup>2</sup>	6	10	6	6		46	46	46	46	46	46	50	50	52	52	36		48	48
	$T_e$ (K)	500 <sup>2</sup>						750	750	750	750	750	750	1 500	1 100	1 500	1 100	2 636		1 100	1 100
Reference bandwidth	$B$ (Hz)	$4 \times 10^3$	$150 \times 10^3$	$37.5 \times 10^3$	$150 \times 10^3$	$10^6$		$4 \times 10^3$	$10^6$	$4 \times 10^3$	$10^6$	$4 \times 10^3$	$10^6$	$4 \times 10^3$	$10^6$	$4 \times 10^3$	$10^6$	$10^7$		$10^6$	$10^6$
Permissible interference power	$P_f(p)$ (dBW) in $B$	-140	-160	-157	-160	-143		-131	-103	-131	-103	-131	-103	-128	-98	-128	-98	-131		-113	-113

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<sup>1</sup> A: analogue modulation; N: digital modulation.

<sup>2</sup> The parameters for the terrestrial station associated with transhorizon systems have been used. Line-of-sight radio-relay parameters associated with the frequency band 5 725-7 075 MHz may also be used to determine a supplementary contour with the exception that  $G_x = 37$  dBi.

<sup>3</sup> Feeder links of non-geostationary-satellite systems in the mobile-satellite service.

<sup>4</sup> Feeder losses are not included.

<sup>5</sup> Actual frequency bands are 7 100-7 155 MHz and 7 190-7 235 MHz for space operation service and 7 145-7 235 MHz for the space research service.

**Reasons:** To provide a coordination mechanism between transmitting earth stations in 14.5-15.35 GHz and fixed and mobile earth stations. Aeronautical mobile stations are already addressed through Table 10 of Appendix 7.

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APPENDIX 30A (REV.WRC-15)\*

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**Provisions and associated Plans and List<sup>1</sup> for feeder links for the broadcasting-satellite service (11.7-12.5 GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz<sup>2</sup> and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2** (Rev. WRC-15)

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(See Articles 9 and 11) (WRC-03)

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ARTICLE 4 (REV.WRC-15)

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**Procedures for modifications to the Region 2 feeder-link Plan or for additional uses in Regions 1 and 3**

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**4.1 PROVISIONS APPLICABLE TO REGIONS 1 AND 3**

\* The expression “frequency assignment to a space station”, wherever it appears in this Appendix, shall be understood to refer to a frequency assignment associated with a given orbital position. (WRC-03)

<sup>1</sup> The Regions 1 and 3 feeder-link List of additional uses is annexed to the Master International Frequency Register (see Resolution 542 (WRC-2000)\*\*). (WRC-03)

<sup>2</sup> This use of the band 14.5-14.8 GHz is reserved for countries outside Europe.

\*\* *Note by the Secretariat:* This Resolution was abrogated by WRC-03.

*Note by the Secretariat:* Reference to an Article with the number in roman is referring to an Article in this Appendix.

4.1.1 An administration proposing to include a new or modified assignment in the feeder-link List shall seek the agreement of those administrations whose services are considered to be affected, i.e. administrations<sup>4, 5</sup>:

- a) of Regions 1 and 3 having a feeder-link frequency assignment in the fixed-satellite service (Earth-to-space) to a space station in the broadcasting-satellite service which is included in the Regions 1 and 3 feeder-link Plan with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment; *or*
- b) of Regions 1 and 3 having a feeder-link frequency assignment included in the feeder-link List or for which complete Appendix 4 information has been received by the Radiocommunication Bureau in accordance with the provisions of § 4.1.3, and any portion of which falls within the necessary bandwidth of the proposed assignment; *or*
- c) of Region 2 having a feeder-link frequency assignment in the fixed-satellite service (Earth-to-space) to a space station in the broadcasting-satellite service which is in conformity with the Region 2 feeder-link Plan, or in respect of which proposed modifications to that Plan have already been received by the Bureau in accordance with the provisions of § 4.2.6 with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment; *or*
- d) having a feeder-link frequency assignment in the band 17.8-18.1 GHz in Region 2 in the fixed-satellite service (Earth-to-space) to a space station in the broadcasting-satellite service or a frequency assignment in the band 14.5-14.8 GHz in the fixed-satellite service (Earth-to-space) not subject to the Regions 1 and 3 feeder-link Plan or List which is recorded in the Master Register or which has been coordinated or is being coordinated under the provisions of No. 9.7, or under § 7.1 of Article 7, with a necessary bandwidth, any portion of which falls within the necessary bandwidth of the proposed assignment. (Rev. WRC-15)

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**Reasons:** to add mechanisms for coordination between fixed-satellite service allocation in 14.5-14.8 GHz with the Regions 1 and 3 feeder-link Plan or List.

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<sup>4</sup> Agreement with administrations having a frequency assignment in the bands 14.5-14.8 GHz or 17.7-18.1 GHz to a terrestrial station, or having a frequency assignment in the band 17.7-18.1 GHz to an earth station in the fixed-satellite service (space-to-Earth), or having a frequency assignment in the band 17.3-17.8 GHz in the broadcasting-satellite service shall be sought under No. 9.17, No. 9.17A or No. 9.19, respectively.

<sup>5</sup> Coordination under Nos. 9.17 or 9.17A is not required for an earth station of an administration on the territory of which this earth station is located and for which the procedures of former § 4.2.1.2 and 4.2.1.3 of Appendix 30A (WRC-97) have been successfully applied by that administration before 3 June 2000 in respect of terrestrial stations or earth stations operating in the opposite direction of transmission. (WRC-03)

**Coordination, notification and recording in the Master International Frequency Register of frequency assignments to stations in the fixed-satellite service (space-to-Earth) in Region 1 in the band 17.3-18.1 GHz and in Regions 2 and 3 in the band 17.7-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in Region 2 in the band 17.8-18.1 GHz, to stations in the fixed-satellite service (Earth-to-space) in any region in the band 14.5-14.8 GHz where those stations are not subject to the Regions 1 and 3 feeder-link Plan or List and to stations in the broadcasting-satellite service in Region 2 in the band 17.3-17.8 GHz when frequency assignments to feeder links for broadcasting-satellite stations in the 17.3-18.1 GHz band in Regions 1 and 3 or in the band 17.3-17.8 GHz in Region 2 are involved<sup>28</sup>**

**Section I – Coordination of transmitting space or earth stations in the fixed-satellite service or transmitting space stations in the broadcasting-satellite service with assignments to broadcasting-satellite service feeder links**

7.1 The provisions of No. 9.7<sup>29</sup> and the associated provisions under Articles 9 and 11 are applicable to transmitting space stations in the fixed-satellite service in Region 1 in the band 17.3-18.1 GHz, to transmitting space stations in the fixed-satellite service in Regions 2 and 3 in the band 17.7-18.1 GHz, to transmitting earth stations in the fixed-satellite service in Region 2 in the band 17.8-18.1 GHz, to transmitting earth stations in the fixed-satellite service in any region in the band 14.5-14.8 GHz where those stations are not subject to the Regions 1 and 3 feeder-link Plan or List and to transmitting space stations in the broadcasting-satellite service in Region 2 in the band 17.3-17.8 GHz. (Rev.WRC-15)

7.2 In applying the procedures referred to in § 7.1, the provisions of Appendix 5 are replaced by the following:

7.2.1 The frequency assignments to be taken into account are:

- a) the assignments in conformity with the appropriate Regional feeder-link Plan in Appendix 30A;
- b) the assignments included in the Regions 1 and 3 feeder-link List;

<sup>28</sup> These provisions do not replace the procedures prescribed in Articles 9 and 11 when stations other than those for feeder links in the broadcasting-satellite service subject to a Plan are involved. (WRC-03)

<sup>29</sup> The provisions of Resolution 33 (Rev.WRC-97)\* are applicable to space stations in the broadcasting-satellite service for which the advance publication information or the request for coordination has been received by the Bureau prior to 1 January 1999.

\* *Note by the Secretariat:* This Resolution was revised by WRC-03.

- c) the assignments for which the procedure of Article 4 has been initiated as from the date of receipt of the complete Appendix 4 information under § 4.1.3 or 4.2.6. (WRC-03)

7.2.2 The criteria to be applied are those given in Annex 4.

**Reasons:** to add mechanisms for coordination between fixed-satellite service allocation in 14.5-14.8 GHz with the Regions 1 and 3 feeder-link Plan or List.

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## ANNEX 1

**Limits for determining whether a service of an administration is considered to be affected by a proposed modification to the Region 2 feeder-link Plan or by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List or when it is necessary under this Appendix to seek the agreement of any other administration** (Rev. WRC-15)

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**6 Limits applicable to protect a frequency assignment in the band 17.8-18.1 GHz (Region 2) to a receiving feeder-link space station in the fixed-satellite service (Earth-to-space) ) or a frequency assignment in the band 14.5-14.8 GHz (any region where the frequency assignment is not subject to the Regions 1 and 3 feeder-link Plan or List) to a receiving space station in the fixed-satellite service (Earth-to-space)** (Rev. WRC-15)

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With respect to § 4.1.1 d) of Article 4, an administration is considered affected by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List when the power flux-density arriving at the receiving space station of a broadcasting-satellite feeder-link in Region 2 or at the receiving space station of the unplanned fixed-satellite service uplinks in any region of that administration would cause an increase in the noise temperature of the receiving space station which exceeds the threshold value of  $\square T/T$  corresponding to 6%, where  $\square T/T$  is calculated in accordance with the method given in Appendix 8, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per hertz averaged over the necessary bandwidth of the uplink carriers. (Rev. WRC-15)

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**Reasons:** to extend the existing coordination trigger for unplanned services and the Plan/List to coordination between fixed-satellite service allocation in 14.5-14.8 GHz with the Regions 1 and 3 feeder-link Plan or List.

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## ANNEX 4 (REV.WRC-15)

### Criteria for sharing between services

- 1 Threshold values for determining when coordination is required between, on one hand, transmitting space stations in the fixed-satellite service or the broadcasting-satellite service and, on the other hand, a receiving space station in the feeder-link Plan or List or a proposed new or modified receiving space station in the List, in the frequency bands 17.3-18.1 GHz (Regions 1 and 3) and in the feeder-link Plan or a proposed modification to the Plan in the frequency band 17.3-17.8 GHz (Region 2)** (WRC-03)

With respect to § 7.1, Article 7, coordination of a transmitting space station in the fixed-satellite service or in the broadcasting-satellite service with a receiving space station in a broadcasting-satellite service feeder link in the Regions 1 and 3 feeder-link Plan or List, or a proposed new or modified receiving space station in the List, or in the Region 2 feeder-link Plan or proposed modification to the Plan is required when the power flux-density arriving at the receiving space station of a broadcasting-satellite service feeder link of another administration would cause an increase in the noise temperature of the feeder-link space station which exceeds a threshold value of  $\square T_s / T_s$  corresponding to 6%.  $\square T_s / T_s$  is calculated in accordance with Case II of the method given in Appendix 8. (WRC-03)

2 **Threshold values for determining when coordination is required between, on one hand, transmitting feeder-link earth stations in the fixed-satellite service in Region 2 in 17.8-18.1 GHz or transmitting earth stations in the fixed-satellite service in 14.5-14.8 GHz not subject to the Regions 1 and 3 feeder-link Plan or List and, on the other hand, a receiving space station in the Regions 1 and 3 feeder-link Plan or List or a proposed new or modified receiving space station in the List, in the frequency bands 14.5-14.8 GHz or 17.8-18.1 GHz (Rev.WRC-15)**

With respect to § 7.1, Article 7, coordination of a transmitting earth station in the fixed-satellite service with a receiving space station in a broadcasting-satellite feeder link in the Regions 1 and 3 feeder-link Plan or List, or a proposed new or modified receiving space station in the List, is required when the power flux density arriving at the receiving space station of a broadcasting-satellite service feeder link of another administration would cause an increase in the noise temperature of the feeder-link space station which exceeds a threshold value of  $\square T/T$  corresponding to 6%, where  $\square T/T$  is calculated in accordance with the method given in Appendix 8, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per hertz averaged over the necessary bandwidth of the feeder-link carriers. (Rev.WRC-15)

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**Reasons:** to extend the existing coordination trigger for unplanned services and the Plan/List to coordination between fixed-satellite service allocation in 14.5-14.8 GHz with the Regions 1 and 3 feeder-link Plan or List.

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