

IWG-3/XXX
(07/31/2014)
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2015 WORLD RADIOCOMMUNICATION CONFERENCE

REVISED DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

AGENDA ITEM 1.7: *to review the use of the band 5 091-5 150 MHz by the fixed-satellite service (Earth-to-space) (limited to feeder links of the non-geostationary mobile-satellite systems in the mobile-satellite service) in accordance with Resolution 114 (Rev. WRC-12)*

ISSUE: This agenda item invites the ITU-R to conduct appropriate studies to review the use of the band 5 091-5 150 MHz by feeder links (Earth-to-space) of non-geostationary mobile-satellite systems with respect to the aeronautical radionavigation service in accordance with Resolution 114 (WRC-12).

BACKGROUND:

At WRC-95, a Primary allocation, subject to **5.444A**, was made to the fixed-satellite service in the 5 091-5 150 MHz band for feeder links to non-GSO mobile-satellite service systems, in the Earth-to-space direction.

~~Doc 3487~~ The 5 091-5 150 MHz frequency band was originally designated for expansion of the international standard Microwave Landing System (MLS) for planned assignments which could not be satisfied in the 5 030-5 091 MHz frequency band and MLS had priority over other uses in the band. At WRC-07, the priority to MLS was removed in the 5 091-5 150 MHz frequency band and the sunset date for assignments to the FSS in this band was extended from 2012 to 2016 (a date after which no new assignments should be made to the FSS). ~~The 5 091-5 150 MHz band was originally designated for expansion of the international standard Microwave Landing System (MLS) and~~ Recommendation ITU-R S.1342 describes a method for determining coordination distances between international standard MLS stations operating in the band 5 030-5 090 MHz and FSS stations providing Earth-to-space feeder links in the 5 091-5 150 MHz band.

At WRC-07, an additional allocation subject to **5.444B** was made, in the 5 091-5 150 MHz band, to the aeronautical mobile service (AMS) for use by surface applications at airports, aeronautical telemetry transmissions from aircraft stations and aeronautical security transmissions. The latter application was suppressed by WRC-12. Compatibility between the newly allocated aeronautical mobile service planned usage and the existing fixed-satellite service usage was demonstrated by extensive studies carried out by the ITU-R in the lead up to WRC-07.

The fixed-satellite service allocation at 5091-5150 MHz is currently used by the HIBLEO-4FL and HIBLEO-X systems and has been used compatibly with other services since 1998. The extensive studies undertaken in preparation for WRC-07 resulted in the creation of No. **5.444B**

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and Resolutions **748 (WRC-07)**, **418 (WRC-07)** and **419 (WRC-07)**¹ and demonstrated compatibility between the fixed-satellite service and each of the aeronautical mobile (route) service applications.

The operator of the HIBLEO-4FL and HIBLEO-X systems has completed initial phase of the replenishment of its satellite constellation. As these new spacecraft are replacements for existing equipment, they will also utilize the 5 091-5 150 MHz range for feeder links in the Earth-to-space direction. The replacement satellites are expected to remain in service beyond the year 2025.

As a result of these developments, continued FSS use of the 5 091-5 150 MHz band for feeder links of the MSS, Earth-to-space, is required. Taking into account the time constraints contained in **5.444A**, it is necessary to comply with Resolution **114 (WRC-03)** prior to 2018. Recognizing the considerable effort expended in studying the compatibility between the Earth-to-space feeder links of the MSS systems and the Aeronautical Mobile Service in preparation for WRC-07, and since the interference budgets and scenarios studied before remain the same for the HIBLEO-4FL and HIBLEO-X replacement spacecraft, study of technical and operational issues can and should be limited to the sharing of this band between new systems of the aeronautical radionavigation service (ARNS) and the FSS providing feeder links of the non-GSO systems in the MSS.

The continued use of this allocation by feeder uplinks is of great importance in providing ongoing service by MSS systems to developing countries, under-served areas and critical response in the event of natural disasters and other civil emergencies.

~~Ongoing work~~ **finalized** in ITU-R WP 4A on Agenda Item 1.7 in preparation for WRC-15 has resulted in the development of a single suitable method to satisfy the requirements of Resolution **114 (WRC-12)**. Method A objectives are:

- to maintain the primary allocation to the earth to space feeder links,
- to suppress the time limitation dates in **RR 5.444A**,
- that the regulatory provisions of Resolution 114 be retained as revised by WRC-15,
- that coordination between FSS earth stations and ARNS is required in certain circumstances,
- that flexibility for deploying AM(R)S **has been** improved while protecting the FSS, and
- to move the allocation to the FSS from footnote to the Table of Frequency Allocations.

Note: Since Resolution **748 (Rev. WRC-12)** and Recommendation ITU-R M.1827 are parts of the Radio Regulations, modifications to these documents are included in this proposal.

PROPOSAL:

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations

(See No. **2.1**)

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¹ Resolution 419 (WRC-07) was suppressed at WRC-12.

4 800-5 570 MHz

Allocation to services		
Region 1	Region 2	Region 3
§ 091-5-150	<p><u>FIXED-SATELLITE (Earth-to-space)</u> AERONAUTICAL MOBILE 5.444B AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION 5.444 <u>MOD</u> 5.444A</p>	
5 150-5 250	<p>FIXED-SATELLITE (Earth-to-space) 5.447A MOBILE except aeronautical mobile 5.446A 5.446B AERONAUTICAL RADIONAVIGATION 5.446 5.446C 5.447 5.447B 5.447C</p>	

Reasons: Consequential to rendering the fixed-satellite service allocation without time limits.

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5.444A *Additional allocation:* ~~the band 5 091 5 150 MHz is also allocated to the fixed-satellite service (Earth-to-space) on a primary basis. This~~ The use of the allocation to the fixed-satellite service (Earth-to-space) in the band 5 091-5 150 MHz is limited to feeder links of non-geostationary satellite systems in the mobile-satellite service and is subject to coordination under No. 9.11A. The use of the band 5 091-5 150 MHz by feeder links of non-geostationary satellite systems in the mobile-satellite service shall be subject to application of Resolution 114 (Rev.WRC-15). Moreover, to ensure that the aeronautical radionavigation service is protected from harmful interference, coordination is required for feeder-link earth stations of the non-geostationary satellite systems in the mobile-satellite service which are separated by less than 450 km from the territory of an Administration operating ground stations in the aeronautical radionavigation service. Resolution 114 (Rev.WRC-15) applies.

- ~~_____ In the band 5 091 5 150 MHz, the following conditions also apply:~~
- ~~_____ prior to 1 January 2018, the use of the band 5 091 5 150 MHz by feeder links of non-geostationary satellite systems in the mobile-satellite service shall be made in accordance with Resolution 114 (Rev.WRC-03);~~
- ~~_____ after 1 January 2016, no new assignments shall be made to earth stations providing feeder links of non-geostationary mobile satellite systems;~~
- ~~_____ after 1 January 2018, the fixed-satellite service will become secondary to the aeronautical radionavigation service.~~

In the band 5 091 5 150 MHz, the following conditions apply:

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~~to ensure that the aeronautical radionavigation service is protected from harmful interference, coordination is required for feeder link earth stations of non-geostationary satellite systems in the mobile satellite service which are separated by less than 450 km (243 nmi) from ground stations operating in the aeronautical radionavigation service and that Appendix 7 of the Radio Regulations be used for the determination of the coordination area.~~

Reasons: to remove time limits from the fixed-satellite service allocation (limited to feeder links of non-geostationary systems in the mobile-satellite service), while keeping all the other applicable regulatory provisions, i.e. No. **9.11A** and Resolution **114 (Rev.WRC-15)**.

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APPENDIX 7

TABLE 10 (WRC-15)

Predetermined coordination distances

<u>Frequency sharing situation</u>		<u>Coordination distance (in sharing situations involving services allocated with equal rights) (km)</u>
<u>Type of earth station</u>	<u>Type of terrestrial station</u>	
<u>Ground-based in the bands below 1 GHz to which No. 9.11A applies.</u> <u>Ground-based mobile in the bands within the range 1-3 GHz to which No. 9.11A applies</u>	<u>Mobile (aircraft)</u>	<u>500</u>
<u>Aircraft (mobile) (all bands)</u>	<u>Ground-based</u>	<u>500</u>
<u>Aircraft (mobile) (all bands)</u>	<u>Mobile (aircraft)</u>	<u>1 000</u>
<u>Ground-based in the bands:</u> <u>400.15-401 MHz</u> <u>1 668.4-1 675 MHz</u>	<u>Station in the meteorological aids service (radiosonde)</u>	<u>580</u>
<u>Aircraft (mobile) in the bands:</u> <u>400.15-401 MHz</u> <u>1 668.4-1 675 MHz</u>	<u>Station in the meteorological aids service (radiosonde)</u>	<u>1 080</u>
<u>Ground-based in the radiodetermination-satellite service (RDSS) in the bands:</u> <u>1 610-1 626.5 MHz</u> <u>2 483.5-2 500 MHz</u> <u>2 500-2 516.5 MHz</u>	<u>Ground-based</u>	<u>100</u>
<u>Airborne earth station in the radiodetermination-satellite service (RDSS) in the bands:</u>	<u>Ground-based</u>	<u>400</u>

1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz		
<u>Receiving earth stations in the meteorological-satellite service</u>	<u>Station in the meteorological aids service</u>	<u>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)</u>
<u>Non-GSO MSS feeder-link earth stations (all bands)</u>	<u>Mobile (aircraft)</u>	<u>500 (see Note 2)</u>
<u>Ground-based in the bands in which the frequency sharing situation is not covered in the rows above</u>	<u>Mobile (aircraft)</u>	<u>500</u>

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 ϵ_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° and less than 0°. (WRC-2000)

NOTE 2 – For the coordination distance in the band 5 091-5 150 MHz vis-à-vis stations in the aeronautical radionavigation service, see, No. **5.444A**, (WRC-15)

Reason: In order to avoid any confusion the coordination distance vis-à-vis a specific service determined by a specific footnote (i.e. No. **5.444A**) needs to be specified.

Field Code Changed

Field Code Changed

Field Code Changed

Appendix 7

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	Aeronautical mobile-satellite (R) service	Aeronautical 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 ³	Fixed-satellite	Fixed-satellite ³
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 ⁵	7.900-8.400	10.7-11.7	12.5-14.8	13.75-14.3	15.43-15.65	17.7-18.4	19.3-19.7
Receiving terrestrial service designations	Fixed, mobile	Aeronautical radionavigation	Aeronautical mobile (R)	Aeronautical radionavigation	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	§ 2.2		§ 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 [†]	A						A N	A N	A N	A N	A N	A N	=	N	N
Terrestrial station interference	P_0 (%)	0.01					0.01 0.005	0.01 0.005	0.01 0.005	0.01 0.005	0.01 0.005	0.01 0.005	0.01		0.005 0.005
	#	2					2 2	2 2	2 2	2 2	2 2	2 2	1		2 2

see parameters and criteria	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^{-2}						33	37	33	37	33	37	33	40	33	40	†	25	25	
	W (dB)	0						0	0	0	0	0	0	0	0	0	0		0	0	
Terrestrial station parameters	G_x (dBi) ⁴	49^{-2}	6	10	6	6		46	46	46	46	46	46	50	50	52	52	36	48	48	
	F_c (K)	500^{-2}						750	750	750	750	750	750	1500	1100	1500	1100	2636	1100	1100	
Reference bandwidth	B (Hz)	4×10^3	150×10^3	37.5×10^3	150×10^3	10^6		4×10^3	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

†—A: analogue modulation; N: digital modulation.

²—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.

³—Feeder links of non-geostationary satellite systems in the mobile satellite service.

⁴—Feeder losses are not included.

⁵—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 reflect the method of coordination that is to be used between earth stations of the fixed satellite service and stations of the aeronautical radio navigation service.

RESOLUTION 114 (Rev. WRC-~~12~~15)

~~Studies on e~~Compatibility between ~~new systems of~~ the aeronautical radionavigation service and the fixed-satellite service (Earth-to-space) (limited to feeder links of the non-geostationary mobile-satellite systems in the mobile-satellite service) in the frequency band 5 091-5 150 MHz

The World Radiocommunication Conference (Geneva, ~~2012~~2015),

considering

- a) the current allocation of the frequency band 5 000-5 250 MHz to the aeronautical radionavigation service;
- b) the requirements of both the aeronautical radionavigation and the fixed-satellite (FSS) (Earth-to-space) (limited to feeder links of non-geostationary satellite (non-GSO) systems in the mobile-satellite service (MSS)) services in the above-mentioned band,

recognizing

- a) that priority must be given to the microwave landing system (MLS) in accordance with No. **5.444** and to other international standard systems of the aeronautical radionavigation service in the frequency band 5 030-5 ~~091+50~~ MHz;
- b) that, in accordance with Annex 10 of the Convention of the International Civil Aviation Organization (ICAO) on international civil aviation, it may be necessary to use the frequency band 5 091-5 150 MHz for the MLS if its requirements cannot be satisfied in the frequency band 5 030-5 091 MHz;
- c) that the FSS providing feeder links for non-GSO systems in the MSS will need continuing access to the frequency band 5 091-5 150 MHz ~~in the short/long term~~,

noting

- a) that Recommendation ITU-R S.1342 describes a method for determining coordination distances between international standard MLS stations operating in the band 5 030-5 091 MHz and FSS earth stations providing Earth-to-space feeder links in the band 5 091-5 150 MHz;
- b) the small number of FSS stations to be considered;
- ~~e) the development of new systems that will provide supplemental navigation information integral to the aeronautical radionavigation service;~~

resolves

- 1 that administrations authorizing stations providing feeder links for non-GSO systems in the MSS in the frequency band 5 091-5 150 MHz shall ensure that they do not cause harmful interference to stations of the aeronautical radionavigation service;
- ~~2 that the allocation to the aeronautical radionavigation service and the FSS in the frequency band 5 091-5 150 MHz should be reviewed at a future competent conference prior to 2018;~~
- ~~3 that studies be undertaken on compatibility between new systems of the aeronautical radionavigation service and systems of the FSS providing feeder links of the non-GSO systems in the MSS (Earth-to-space);~~

invites administrations

when assigning frequencies in the band 5 091-5 150 MHz ~~before 1 January 2018~~ to stations of the aeronautical radionavigation service or to stations of the FSS providing feeder links of the non-GSO

systems in the MSS (Earth-to-space), to take all practicable steps to avoid mutual interference between them,

invites ITU-R

~~to study the technical and operational issues relating to sharing of this band between new systems of the aeronautical radionavigation service and the FSS providing feeder links of the non-GSO systems in the MSS (Earth-to-space);~~

invites

~~1 ICAO to supply technical and operational criteria suitable for sharing studies for new aeronautical systems;~~

~~2 all Members of the Radiocommunication Sector, and especially ICAO, to participate actively in such studies;~~

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

Reasons: Consequential changes as a result of rendering the fixed-satellite service allocation (limited to feeder links of non-geostationary systems in the mobile-satellite service) without time limits.

RESOLUTION 748 (Rev.WRC-~~1215~~)

Compatibility between the aeronautical mobile (R) service and the fixed-satellite service (Earth-to-space) in the band 5 091-5 150 MHz

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The World Radiocommunication Conference (Geneva, ~~2012~~2015),

considering

a) that the allocation of the 5 091-5 150 MHz band to the fixed-satellite service (FSS) (Earth-to-space) is limited to feeder links of non-geostationary-satellite (non-GSO) systems in the mobile-satellite service (MSS);

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b) that the frequency band 5 000-5 150 MHz is currently allocated to the aeronautical mobile-satellite (R) service (AMS(R)S), subject to agreement obtained under No. 9.21, and to the aeronautical radionavigation service (ARNS);

c) that WRC-07 allocated the band 5 091-5 150 MHz to the aeronautical mobile service (AMS) on a primary basis subject to No. 5.444B;

d) that the International Civil Aviation Organization (ICAO) is in the process of identifying the technical and operating characteristics of new systems operating in the AM(R)S in the band 5 091-5 150 MHz;

e) that the compatibility of one AM(R)S system, to be used by aircraft operating on the airport surface, and the FSS has been demonstrated in the 5 091-5 150 MHz band;

f) that ITU-R studies have examined potential sharing among AMS aeronautical applications and the FSS in the band 5 091-5 150 MHz and have shown that the aggregate interference from aeronautical telemetry and AM(R)S should total no more than 3% AT/T;

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g) that the frequency band 117.975-137 MHz currently allocated to the AM(R)S is reaching saturation in certain areas of the world, and therefore that band would not be available to support additional surface applications at airports;

h) that this new allocation is intended to support the introduction of applications and concepts in air traffic management which are data intensive, and which will support data links that carry safety-critical aeronautical data,

recognizing

a) that in the frequency band 5 030-5 091 MHz priority is to be given to the microwave landing system (MLS) in accordance with No. 5.444;

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b) that ICAO publishes recognized international aeronautical standards for AM(R)S systems;

c) that Resolution 114 (Rev.WRC-~~1215~~) applies to the sharing conditions between the FSS and ARNS in the 5 091-5 150 MHz band,

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noting

- a) that the number of FSS transmitting stations required may be limited;
- b) that the use of the band 5 091-5 150 MHz by the AM(R)S needs to ensure protection of the current or planned use of this band by the FSS (Earth-to-space);
- c) that ITU-R studies describe methods for ensuring compatibility between the AM(R)S and FSS operating in the band 5 091-5 150 MHz, and compatibility has been demonstrated for the AM(R)S system referred to in *considering e*),

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resolves

- 1 that any AM(R)S systems operating in the band 5 091-5 150 MHz shall not cause harmful interference to, nor claim protection from, systems operating in the ARNS;
- 2 that any AM(R)S systems operating in the frequency band 5 091-5 150 MHz shall meet the SARPs requirements published in Annex 10 of the ICAO Convention on International Civil Aviation and the requirements of Recommendation ITU-R M.1827-1~~4~~ to ensure compatibility with FSS systems operating in that band;
- 3 that, in part to meet the provisions of No. **4.10**, the coordination distance with respect to stations in the FSS operating in the band 5 091-5 150 MHz shall be based on ensuring that the signal received at the AM(R)S station from the FSS transmitter does not exceed -143 dB(W/MHz), where the required basic transmission loss shall be determined using the methods described in Recommendations ITU-R P.525-2 and ITU-R P.526-11,

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invites

- 1 administrations to supply technical and operational criteria necessary for sharing studies for the AM(R)S, and to participate actively in such studies;
- 2 ICAO and other organizations to actively participate in such studies,

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instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

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Reason: To improve the operational flexibility of the aeronautical-mobile (Route) service and to reflect the revision of Recommendation ITU-R M.1827.

NOTE: Resolution **748 (Rev.WRC-12)** is referred to in *recognizing c*) of Resolution **418 (Rev.WRC-12)**. Should WRC-15 revise Resolution **748 (Rev.WRC-12)**, a consequential update of the reference would be need in Resolution **418 (Rev.WRC-12)**.