

PLENARY MEETING

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Working Group 4.1

PROPOSED TEXT FOR THE CPM REPORT

AGENDA ITEM 1.7

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

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);*

Resolution 114 (Rev.WRC-12): *Studies on 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*

4.1/1.7/1 Executive summary

Resolution 114 (Rev.WRC-12) calls for a review of allocations to both the aeronautical radionavigation service (ARNS) and the fixed-satellite service (FSS) in the band 5 091-5 150 MHz. In particular, studies are called for in *resolves* 3 between any new ARNS and the systems of the FSS providing feeder links of non-GSO systems in the mobile-satellite service (MSS) (Earth-to-space). In the *invites*, ICAO is asked to supply technical and operational criteria suitable for sharing studies for new aeronautical systems. During the study cycle, no additional information was received from ICAO in regards to the *invites* 1 in Resolution 114 (Rev.WRC-12) as no new ARNS systems in the band 5 091-5 150 MHz are foreseen other than the international standard system (microwave landing system (MLS)) for precision approach and landing. On this basis, no new studies were required in the band 5 091-5 150 MHz and ITU-R concluded that the regulatory conditions contained in Resolution 114 (Rev.WRC-12) and the technical and operational requirements contained in Recommendation ITU-R S.1342 will continue to ensure the compatibility of the FSS providing Earth-to-space feeder links in the band 5 091-5 150 MHz and international standard MLS operating in the adjacent band 5 030-5 091 MHz. Accordingly, the time limitations attached to the FSS allocation can be suppressed, while maintaining the application of Resolution 114 (Rev.WRC-12), with consequential modifications. A method transposing these findings into regulatory provisions is therefore proposed to satisfy this agenda item.

4.1/1.7/2 Background

Initially, the band 5 091-5 150 MHz was allocated to the ARNS on a primary basis and was subsequently reserved as an extension MLS band to meet requirements for future planned MLS assignments which could not be satisfied in the core MLS band 5 030-5 091 MHz. Afterwards, RR No. **5.444A** introduced an additional allocation to permit use of the MLS extension band 5 091-5 150 MHz by the FSS feeder links on a primary basis. The current regulatory conditions under RR No. **5.444A** permit use of the band 5 091-5 150 MHz by the FSS feeder links, with a foreseen reversion to secondary in 2018, subject to the requirements of RR No. **5.444** to protect MLS assignments and to avoid causing interference to the ARNS. The 5 030-5 091 MHz core MLS band supports 200 internationally standardized channels for use by MLS systems. Channels may be re-used within a Region or country, whenever sufficient geographic separation exists between MLS systems. Originally, in accordance with RR No. **5.444**, MLS had priority over other uses in the band 5 030-5 150 MHz. At WRC-07, the priority to MLS was removed in the band 5 091-5 150 MHz 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). A review of the allocation to the FSS and ARNS in this band is therefore scheduled for WRC-15.

4.1/1.7/3 Summary of technical and operational studies, including a list of relevant ITU-R Recommendations

Previous studies have resulted in Recommendation ITU-R S.1342 which 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 in the adjacent band 5 091-5 150 MHz providing Earth-to-space feeder links for non-geostationary MSS systems.

Previous studies have also resulted in the creation of Recommendation ITU-R M.1827 which provides the technical and operational requirements for stations of the aeronautical mobile (R) service (AM(R)S) limited to surface applications at airports ensuring compatibility with FSS feeder link earth stations operating in the band 5 091-5 150 MHz.

4.1/1.7/3.1 Summary of studies performed

ICAO indicated during the study cycle that it does not foresee or plan any new ARNS (non MLS) systems, in the band 5 091-5 150 MHz. On this basis, no new studies in that band were required. Recommendation ITU-R S.1342 remains the technical reference for determining the need for coordination between the international standard MLS, in the band 5 030-5 091 MHz, and systems of the FSS providing Earth-to-space feeder links, in the adjacent band 5 091-5 150 MHz.

4.1/1.7/3.2 Applicable Recommendations

Recommendations ITU-R S.1342 and ITU-R M.1827.

4.1/1.7/4 Analysis of the results of studies

Based on the information from ICAO that no new ARNS system is planned in the band 5 091-5 150 MHz, the regulatory conditions contained in Resolution **114 (Rev.WRC-12)** and the technical and operational requirements contained in Recommendation ITU-R S.1342 will continue to ensure the compatibility of the FSS providing Earth-to-space feeder links, in the band 5 091-5 150 MHz, and international standard MLS in the band 5 030-5 091 MHz.

4.1/1.7/5 Method to satisfy the agenda item

The Method proposes:

- that the use of the band 5 091-5 150 MHz by systems of the FSS providing Earth-to-space feeder links of non-GSO systems in the MSS be maintained as a primary allocation;
- that each of the time limits on this allocation given in RR No. **5.444A**, i.e. after 1 January 2016 no new assignments shall be made, and after 1 January 2018 the FSS will become secondary to the ARNS, be suppressed;
- that the text specifying that “use of the band 5 091-5 150 MHz by FSS feeder links shall be made in accordance with Resolution **114 (Rev.WRC-15)**” be added to the footnote;
- that coordination between FSS earth stations and ARNS ground stations is required under certain circumstances to ensure that the ARNS is protected from harmful interference and that a fixed distance be used in determining the coordination area; and
- that flexibility for AM(R)S be improved while ensuring protection of the FSS.

An improved flexibility would be possible for managing the interference contribution from AM(R)S by allowing its contribution to $\Delta T_s/T_s$ to increase beyond the 2% limit, set forth in Recommendation ITU-R M.1827-1, whenever the ARNS contribution is below 3%. When the ARNS contribution is above 3%, the current hard limit of 2% on the AM(R)S contribution still applies.

Reasons: The Method has been developed to satisfy the *resolves* part of Resolution **114 (Rev.WRC-12)** that the allocations to the ARNS and the FSS be reviewed prior to 2018 and that studies be undertaken between new systems of the ARNS and systems of the FSS providing feeder links of the non-GSO systems in the MSS (Earth-to-space) in the band 5 091-5 150 MHz. In addition, considering that the long term operating requirements of the FSS feeder links need to be maintained, suppression of the time limitations in RR No. **5.444A** is required, while continuing to protect the operation of the international standard MLS. Further, the consequential amendment of Recommendation ITU-R M.1827 allows for improved flexibility in managing the permitted interference from AM(R)S by allowing its contribution to $\Delta T_s/T_s$ to increase beyond 2%.

Advantages:

- By suppressing the time limitations on the FSS feeder links authorized in RR No. **5.444A**, a long-term, stable sharing environment amongst the primary allocated services in the band 5 091-5 150 MHz will be preserved;
- Revision of Resolution **748 (WRC-12)**, along with the revision of Recommendation ITU-R M.1827, will provide more flexibility for managing the potential interference from AM(R)S systems sharing spectrum with the FSS in the band 5 091-5 150 MHz, and allow MSS systems to maintain their current level of service including to areas that are underserved by other means of communications;
- The Method satisfactorily addresses the *resolves* part of Resolution **114 (Rev.WRC-12)**.

Disadvantages:

- No disadvantages were identified for the Method.

4.1/1.7/6 Regulatory and procedural considerations

ARTICLE 5

Frequency allocations

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

MOD

4 800-5 570 MHz

Allocation to services		
Region 1	Region 2	Region 3
5 091-5 150	FIXED-SATELLITE (Earth-to-space) 5.444A AERONAUTICAL MOBILE 5.444B AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION 5.444 5.444A	
5 150-5 250	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	

Reasons: The FSS allocation has been moved from footnote RR No. **5.444A** to the Table of Frequency Allocations as a consequence of rendering the FSS 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.~~

~~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;~~

* ~~Note by the Secretariat: This Resolution was revised by WRC-12.~~

~~after 1 January 2018, the fixed satellite service will become secondary to the aeronautical radionavigation service. (WRC-07)~~

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

APPENDIX 7 (REV.WRC-12)

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

ANNEX 7

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

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TABLE 10 (Rev.WRC-0715)

Predetermined coordination distances

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 (see Note 2)
Ground-based in the bands in which the frequency sharing situation is not covered in the rows above	Mobile (aircraft)	500

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:

$$\begin{aligned} d &= 100 && \text{for } \varepsilon_h \geq 11^\circ \\ d &= 582 \left(\sqrt{1 + (0.254 \varepsilon_h)^2} - 0.254 \varepsilon_h \right) && \text{for } 0^\circ < \varepsilon_h < 11^\circ \\ d &= 582 && \text{for } \varepsilon_h \leq 0^\circ \end{aligned}$$

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)

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

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

Studies on eCompatibility 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 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 FSS allocation (limited to feeder links of non-geostationary systems in the mobile-satellite service) without time limits.

MOD

RESOLUTION 748 (REV.WRC-~~12~~15)

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

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);
- 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% $\Delta T_s/T_s$~~ ;
- 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**;
- b) that ICAO publishes recognized international aeronautical standards for AM(R)S systems;
- c) that Resolution **114 (Rev.WRC-~~12~~15)** applies to the sharing conditions between the FSS and ARNS in the 5 091-5 150 MHz band,

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*),

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, 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,

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,

instructs the Secretary-General

to bring this Resolution to the attention of ICAO.

Reasons: 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)**.