International Telecommunication Union

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Radiocommunication Sector of ITU

Recommendation ITU-R M.1827-1
(01/2015)

Guideline on technical and operational requirements for stations of the aeronautical mobile (R) service limited to surface application at airports in the frequency band 5 091-5 150 MHz

M Series

Mobile, radiodetermination, amateur and related satellite services

150 ITU 1865-2015

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Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R M.1827-1

Guideline on technical and operational requirements for stations of the aeronautical mobile (R) service limited to surface application at airports in the frequency band 5 091-5 150 MHz

(2007-2015)

Scope

This Recommendation provides technical and operational requirements for stations of the aeronautical mobile (route) service (AM(R)S) limited to surface applications at airports in the frequency band 5 091-5 150 MHz that should be used by administrations as a technical guideline for establishing conformance requirements for stations for worldwide use.

Keywords

AM(R)S, FSS, airport, conformance.

Abbreviations/Glossary

AM(R)S	Aeronautical mobile (route) service
ARNS	Aeronautical radionavigation service
FSS	Fixed satellite service

The ITU Radiocommunication Assembly,

considering

a) that the aeronautical stations will operate on a national, regional and international basis around the world;

b) that circulation of aeronautical stations is usually a subject of a number of national and international rules and regulations including satisfactory conformance to a mutually agreed technical standard and operational requirements of the International Civil Aviation Organisation;

c) that there is a need for identifying the technical and operational requirements for the conformance testing of the aeronautical stations;

d) that the identification of technical and operational requirements for aeronautical stations would provide a common technical basis for facilitating conformance testing of aeronautical stations by various national, regional and international authorities and the development of mutual recognition arrangements for conformance of aeronautical stations;

e) that the technical and operational requirements need to achieve an acceptable balance between radiocommunication equipment complexity and the need for effective use of the radio-frequency spectrum,

considering also

a) that there is a requirement to fully protect all primary services in the band 5 091-5 150 MHz;

b) that results of the studies conducted in accordance with Resolution **414 (Rev.WRC-03)** showed the feasibility of using the frequency band 5 091-5 150 MHz by the AM(R)S limited to surface application at airports on a primary basis under certain conditions;

c) that the identification by ITU-R of technical and operational requirements for aeronautical stations operating in the frequency band 5 091-5 150 MHz should prevent unacceptable interference to other services;

d) that technical and operational characteristics should be continuously and accurately measurable and controllable,

recognizing

a) that the frequency band 5 000-5 250 MHz is allocated to the aeronautical radionavigation service (ARNS) on a primary basis;

b) that the frequency band 5 030-5 150 MHz is to be used for the operation of the international standard microwave landing system for precision approach and landing. The frequency band 5 091-5 150 MHz is also used in the FSS for feeder links for non-geostationary mobile-satellite service systems. The requirements of the international standard microwave landing system shall take precedence over other uses of the band 5 030-5 091 MHz in accordance with No. **5.444** of the Radio Regulations,

recommends

1 that the technical and operational requirements for stations of AM(R)S limited to surface application at airports in the frequency band 5 091-5 150 MHz given in Annex 1 should be used by administrations as a guideline for ensuring compatibility with the fixed satellite service (FSS).

2 the following Note is considered as part of this Recommendation.

NOTE – Due to the fact that other limits may also be acceptable and that all essential requirements are not covered by this Recommendation, further study is required, in particular with respect to the flexible apportionment of $\Delta T_s/T_s$ approach used in this Recommendation

Annex 1

Essential requirements related to compatibility with fixed satellite service networks in the frequency band 5 091-5 150 MHz

For the analyses that follow, Table 1 summarizes the assumed FSS receiver characteristics.

TABLE 1

Parameter values used in satellite interference calculations

Parameter	Units	HIBLEO-4 FL
Satellite receiver noise temperature T	K	550
Antenna effective area at 5 120 MHz	dB(m^2)	–35.6
Polarization discrimination L_p	dB	1
Feed loss L_{feed}	dB	2.9
Satellite receiver bandwidth B	MHz	1.23
Satellite receive antenna gain G_r	dBi	4

NOTE – The compliance with the pfds defined below would be obtained under free-space propagation conditions.

Requirements on the aeronautical mobile (route) service

The requirements that follow represent technical guidelines to be used by administrations for establishing conformance requirements for stations for worldwide use. Other limits may also be acceptable, however further study is required.

The pfd defined in this section is based on ensuring that the increase in noise temperature of the FSS satellite due to operation in the frequency band 5 091-5 150 MHz of the AM(R)S (i.e. $(\Delta T_s/T_s)_{AM(R)S}$) does not exceed the greater of the following two values:

1) 2%

2) $5\% - (\Delta T_s/T_s)_{ARNS}$

where:

$(\Delta T_s/T_s)_{ARNS}$: is the increase in noise temperature due to the ARNS in the same band.

Three examples of this calculation are provided below. The first assumes that the $(\Delta T_s/T_s)_{ARNS}$ is 3%. The second assumes that no ARNS is present in the band. The third assumes that $(\Delta T_s/T_s)_{ARNS}$ is >3%. The methodology assumes 250^2 co-channel AM(R)S transmitters operating concurrently within the field of view of the FSS satellite.

Example 1: $(\Delta T_s/T_s)_{ARNS} = 3\%$

In this case, $5\% - (\Delta T_s/T_s)_{ARNS}$ equals 2%, hence, $(\Delta T_s/T_s)_{AM(R)\,S} = 2\%$, i.e. –17 dB.

Assuming the Table 1 characteristics for the FSS, the maximum aggregate interference level tolerable at the receiver input is $I_{Agg\text{-}Rec}$:

$$I_{Agg-Rec} = KTB - 17\ \text{dB} = -157.3\ \text{dB(W/1.23 MHz)}$$

where:

K: Boltzmann's constant (1.38×10^{-23} J/K)

T: receiver noise temperature (K)

B: receiver bandwidth (Hz).

Therefore at the satellite receiver antenna input the maximum pfd level produced by one AM(R)S transmitter is:

$$\begin{aligned} pfd_{Max} &= I_{Agg-Rec} - Gr + L_{Feed} + L_P - 10\log_{10}(250) + 10\log\left(\frac{4\pi}{\lambda^2}\right) \\ &= -157.3 - 4 + 2.9 + 1 - 23.97 + 35.6 \\ &= -145.77\ \text{dBW}/(\text{m}^2 \times 1.23\ \text{MHz}) \end{aligned}$$

where:

Gr: FSS receiver antenna gain

250: maximum number of AM(R)S stations emitting simultaneously in the FSS receiver bandwidth.

Example 2: $(\Delta T_s/T_s)_{ARNS} = 0$

In this case, $5\% - (\Delta T_s/T_s)_{ARNS}$ equals 5%, which is greater than 2%, Hence, $(\Delta T_s/T_s)_{AM(R)S} = 5\%$, i.e. –13 dB.

Hence:

$$I_{Agg-Rec} = KTB - 13\,\text{dB} = -153.3\,\text{dB(W/1.23 MHz)}$$

Therefore at the satellite receiver antenna input the maximum pfd level produced by one AMRS transmitter is:

$$\begin{aligned} pfd_{Max} &= I_{Agg-Rec} - Gr + L_{Feed} + L_P - 10\log_{10}(250) + 10\log\left(\frac{4\pi}{\lambda^2}\right) \\ &= -153.3 - 4 + 2.9 + 1 - 23.97 + 35.6 \\ &= -141.77\ \text{dBW/(m}^2 \times 1.23\ \text{MHz)} \end{aligned}$$

Example 3: $(\Delta T_s/T_s)_{\text{ARNS}} > 3\%$

In this case, 5% – $(\Delta T_s/T_s)_{\text{ARNS}}$ is smaller than 2%, Hence, $(\Delta T_s/T_s)_{\text{AM(R)S}}$ = 2%, i.e. –17 dB, as in Example 1, and the same pfd_{Max} value is obtained as in Example 1.