

RECOMMENDATION ITU-R M.1231

**INTERFERENCE CRITERIA FOR SPACE-TO-EARTH LINKS OPERATING
IN THE MOBILE-SATELLITE SERVICE WITH NON-GEOSTATIONARY
SATELLITES IN THE 137-138 MHz BAND**

(Question ITU-R 83/8)

(1997)

Summary

In this Recommendation, the interference criteria for downlinks of FDMA non-GSO MSS networks and SSMA non-GSO MSS networks are recommended in terms of the maximum aggregate interference levels.

The ITU Radiocommunication Assembly,

considering

- a) that interference criteria are needed to ensure that systems can be designed to achieve adequate performance in the presence of interference;
- b) that interference criteria may be determined using the methodology described in Recommendation ITU-R SA.1022 and the performance objectives specified in Recommendation ITU-R 1230;
- c) that interference criteria assist in the development of criteria for sharing bands among systems, including those operating in other services;
- d) that systems in the mobile-satellite service (MSS) in the 137-138 MHz band must accept interference at least equal to the permissible levels;
- e) that two general types of modulation are to be considered for non-geostationary (non-GSO) MSS operating in the 137-138 MHz band, which are: narrow-band modulation with frequency division multiple access (FDMA), and wideband modulation with direct sequence spread spectrum multiple access (DS-SSMA);
- f) that Annex 1 presents the parameters of two representative systems that provide the basis for permissible levels of interference in the mobile-satellite service in the 137-138 MHz band,

recommends

- 1 that the interference levels specified in Table 1 be used as the total level of interfering signal power at the antenna input of receiving stations operating in the MSS in the 137-138 MHz band;
- 2 that the interference levels defined herein are used as a basis for deriving sharing criteria.

NOTE 1 – The total interfering signal power level that may be exceeded for $p\%$ of the time, where p is less than 20% but greater than the specified short-term time percentage, may be determined by interpolation between the specified values using a logarithmic scale (base 10) for percentage of time and a linear scale for interfering signal power or signal power density (dB) (see Fig. 1).

NOTE 2 – Using the guidelines in Recommendation ITU-R SA.1022, the permissible levels of interference may be scaled for application to stations with antenna gain or bandwidth values that differ from the specified values.

NOTE 3 – The interference criteria are based on the systems described in Annex 1. The interference criteria for systems using narrow-band modulation with FDMA techniques are given in terms of power levels in the reference bandwidth of the ground station receiver. The interference criteria associated with wideband modulations with DS-SSMA are given in terms of total power contribution of potential interferers in the 137-138 MHz band regardless of the bandwidth of the interferer.

NOTE 4 – The interference criteria are specified with respect to the percentage of time of reception.

NOTE 5 – The interference criteria for the wideband system is predicated on the link budget provided in Table 3. One of the main constraints in developing this link budget is a reduced power flux-density (pfd) required to protect the existing operations of the meteorological-satellite (MetSat) service. This reduction in pfd necessitates a decreased link margin for the wideband non-GSO MSS system, resulting in more restrictive interference criteria than would result in the absence of the MetSat operations. When the MetSat operations move to the 137.025-137.175 MHz and the 137.825 -138.0 MHz bands, the pfd from the future wideband non-GSO MSS may be increased with a corresponding increase in the interference criteria.

TABLE 1

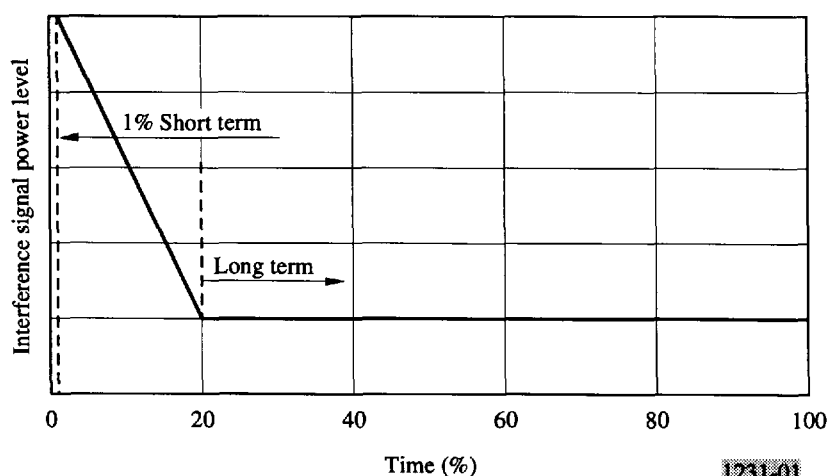
Interference criteria for stations in the mobile-satellite service in the 137-138 MHz band

Modulation type	Function, and earth station platform and antenna	Interfering signal power (dBW) in the reference bandwidth to be exceeded for no more than 20% of the time ⁽¹⁾	Interfering signal power (dBW) in the reference bandwidth to be exceeded for no more than $p_2\%$ of the time ⁽²⁾
Narrow-band modulation and FDMA	Data downlink to gateway (15 dBi horn antenna) Reference bandwidth is 44 kHz	-142.1	-133.4
Narrow-band modulation and FDMA	Data downlink to subscriber terminal (0 dBi monopole antenna with a $\cos^2$ pattern) Reference bandwidth is 19.2 kHz	-155.3	-144.5
Wideband modulation and SSMA (see Note 5)	Data downlink to gateway (16 dBi antenna) Reference bandwidth is 885 kHz	-134.5	-128.5

(1) The interfering signal power level is determined during reception at elevation angles equal to or greater than 20°.

(2) The interfering signal power level is determined during reception at elevation angles equal to or greater than 5° and for $p_2 = 0.25$.

FIGURE 1
Interference criteria model



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ANNEX 1

Basis for interference criteria**1 Introduction**

This Annex presents the parameters used as inputs to the methodology described in Recommendation ITU-R SA.1022 to determine the interference criteria. Tables 2 and 3 summarize these parameters. Additionally, § 5 presents the results of a dynamic analysis which involved computer modelling and simulations which were used to verify the calculated interference levels for the narrow-band system.

2 Non-GSO MSS in the 137-138 MHz band using narrow-band modulation with FDMA

The MSS operating below 1 GHz in non-GSO orbits operates downlinks in the 137-138 MHz band. Typical mobile terminals use an omnidirectional antenna with a 0 dBi gain at low elevation angles, and typical gateway earth stations use a conical horn antenna with a 15 dBi gain.

3 Non-GSO MSS in the 137-138 MHz band using wideband modulation with DS-SSMA

For spread-spectrum transmissions, reception by mobile terminals is not contemplated at the moment. Only gateway earth stations are considered here. They use a directive antenna with a 16 dBi antenna gain.

4 Interference criteria

The interference criteria establishes the total power from all potential interference sources that a system can tolerate and still provide an acceptable grade of service. Using the system's link budget and the performance objectives specified, the total interference power level is calculated. This level is determined by taking the margin available in the link, making some simplifying assumptions as explained in Recommendation ITU-R SA.1022 and separating it into a long-term and a short-term interference criteria (see equations (1) and (2), respectively).

$$i_{20} = n_{p1} + M_{p1} - 4.8 \quad (1)$$

where:

i_{20} : long-term interference criteria (dBW)

n_{p1} : noise power for the time the link is unavailable (dBW)

M_{p1} : short-term margin for the time the link is unavailable (dB).

$$i_{p2} = n_{20} + 10 \log (10^{0.1M_{20}} - 1) \quad (2)$$

where:

i_{p2} : short-term interference criteria (dBW)

n_{20} : noise power to be exceeded for no more than 20% of the time (dBW)

M_{20} : long-term link margin (dB).

It is assumed that the long-term interference criteria is to be limited to less than 20% of the time and that the link is faded. In addition, in order to arrive at the long-term criteria, it is assumed that 33% of the short-term intra-system noise power be allowed as inter-system interference (i.e. an $I/N = -4.8$ dB). The short-term interference criteria is specified as the interfering signal power level that is to be exceeded for no more than some small percentage of time; it is assumed