RECOMMENDATION ITU-R M.1232

SHARING 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 sharing criteria for downlinks of FDMA non-GSO/MSS networks and SSMA non-GSO/MSS networks are recommended in terms of the maximum single-entry interference levels.

The ITU Radiocommunication Assembly,

considering

a) that frequency bands allocated to the mobile-satellite service (MSS) in the band 137-138 MHz may be shared by several systems, including those operating in other services;

b) that Recommendation ITU-R M.1231 specifies the interference criteria needed to determine the sharing criteria;

c) that sharing criteria may be determined using the methodology described in Recommendation ITU-R SA.1023;

d) that Annex 1 presents the parameters used in the implementation of Recommendation ITU-R SA.1023 using the interference criteria arrived at in Recommendation ITU-R M.1231;

e) that the typical deployment of interfering stations may change over a period of years as a result of growth in the number of systems and revisions to frequency band allocations that are adopted by world radio conferences;

f) that the sharing criteria derived using the methodology of Recommendation ITU-R SA.1023 is based on an estimated number of systems that generate interference at significant levels;

g) 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 and direct sequence spread spectrum multiple access (DS-SSMA),

recommends

1 that the single-entry interference levels presented in Table 1 be used as sharing criteria, or as the basis for alternative forms of sharing criteria (e.g., power flux-density limits), for the protection of stations operating in the MSS in the band 137-138 MHz;

2 that the criteria specified in *recommends* 1 be used as the basis for coordination thresholds for receiving stations operating in the MSS in the band 137-138 MHz;

3 that the deployment of interferers specified in Annex 1 be reviewed periodically in order to determine whether the typical interference environment and consequential sharing criteria should be revised.

NOTE 1 – The sharing criteria of Table 1 (including the Notes below) are intended to be applied in frequency sharing analyses and the coordination of frequency assignments (i.e., as the minimum levels of accepted interference for applicable ground stations). In coordination applications, the actual interference environment seen by the receiving ground station should be compared with that assumed in Annex 1 in order to help determine whether interfering signal power greater than the permissible single-entry level can be accepted. Generally, this consideration may enable acceptance of single-entry interference levels that may be as high as those specified in the applicable interference criteria (Recommendation ITU-R M.1231).

TABLE 1

Sharing criteria for stations in the MSS operating in the band 137-138 MHz

Frequency band (MHz) modulation type	Function and type of receiving antenna	Interfering signal power (dBW) in the channel to be exceeded for no more than 20% of the time(1)		Interfering signal power (dBW) in the channel to be exceeded for no more than p% of the time(2)	
		Space-Earth	Terrestrial	Space-Earth	Terrestrial
137-138 (narrow-band modulation with FDMA)	Data downlink to gateway (15 dBi horn antenna) Reference bandwidth is 44 kHz	–146.2(3)	–147.3	–133.8(3) p = 0.0625%	–133.8 p = 0.125%
137-138 (narrow-band modulation with FDMA)	Data downlink to subscriber terminal 0 dBi monopole antenna with a $\cos^2$ pattern Reference bandwidth is 19.2 kHz	–159.9(3)	–160.6	–144.7(3) p = 0.0625%	–144.8 p = 0.125%
137-138 (wideband modulation with DS-SSMA)	Data downlink to gateway (16 dBi antenna) Reference bandwidth is 885 kHz	–138.5(3)	–141.5	–129(3) p = 0.0625%	–129.5 p = 0.125%

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

(2) The interfering signal level is determined during reception at elevation angles equal to or greater than 5°.

(3) As explained in Table 2, this interference power is to be applied to a single constellation of interfering satellites. Usually this number reflects the anticipated number of single interfering transmitters. However, for this Recommendation, this number reflects the number of anticipated interfering constellations. Any limits or thresholds that would apply to a single spacecraft of one of these constellations would be handled during detailed and formal coordination.

NOTE 2 – The single-entry interfering signal power thresholds in Table 1 are the permissible levels of interfering signal power that fall within the specified reference bandwidth. Accordingly, the total power in interfering signals should be considered in frequency sharing analyses. In cases where the interfering signal bandwidth exceeds the reference bandwidth or does not fully overlap the passband of a specific receiver under study, the available frequency dependent rejection should be applied in conjunction with the specified permissible interference levels. Other pertinent ITU-R Recommendations should be consulted for guidance on this matter.

NOTE 3 – The sharing criteria presented in Table 1 are based on representative stations having the specified antenna gain values. Recommendation ITU-R SA.1022 presents a method for scaling the permissible level of total interfering signal power for other antenna gain values. The single-entry criteria also must be scaled in accordance with earth station antenna gain by the same amount of adjustment that would occur for interference criteria using the method in Recommendation ITU-R SA.1022.

NOTE 4 – In deriving the above sharing criteria from permissible total levels of interfering signal power, no allowance has been made for interference from spurious emissions.

NOTE 5 – Both the long-term (20% of the time) and short-term (<1% of the time) sharing criteria must be met in order for interference to be at or below permissible levels.

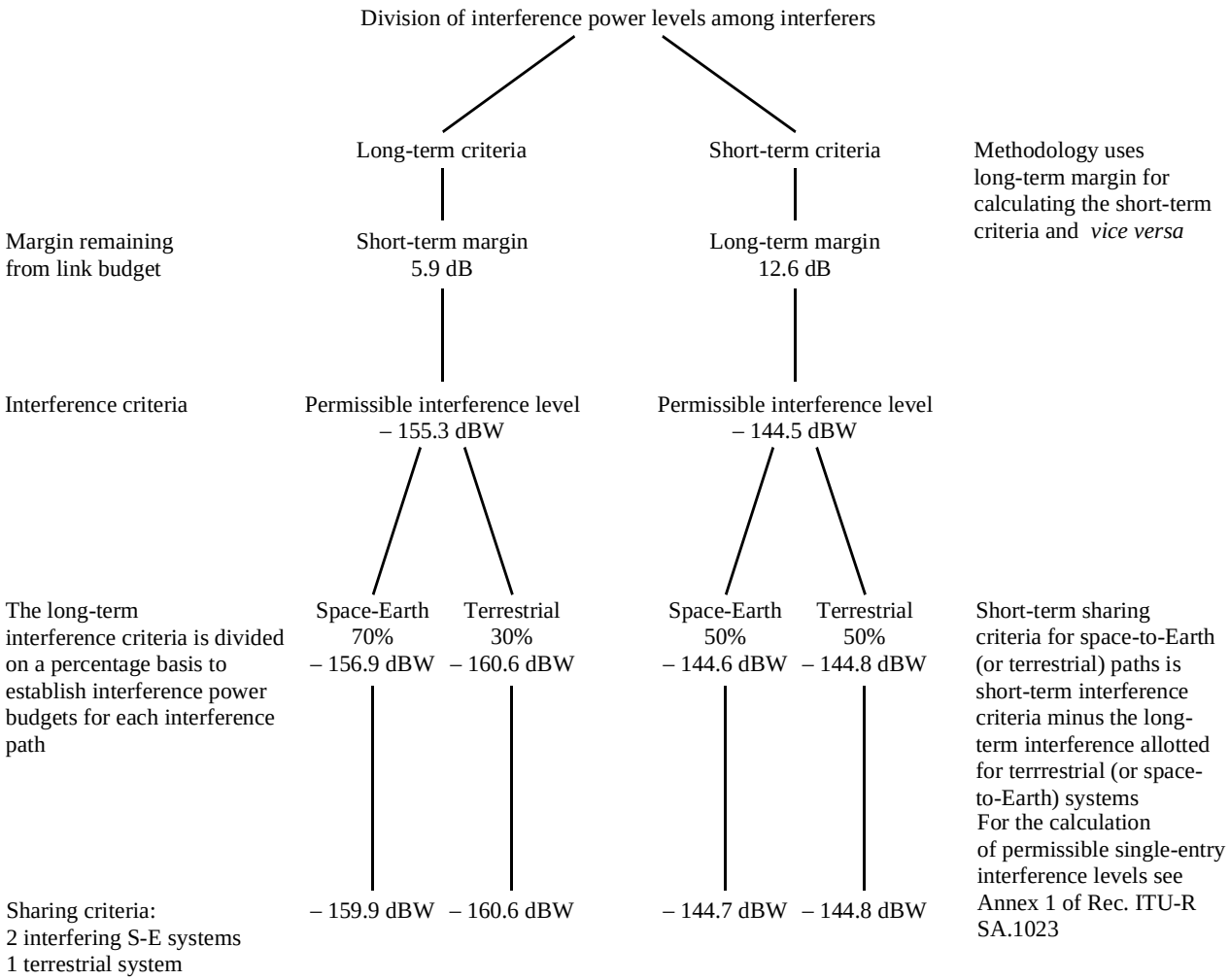
NOTE 6 – Polarization isolation should also be taken into account in evaluating potential interference sources.

NOTE 7 – The values presented in Table 1 are based on two example systems in Recommendations ITU-R M.1230 and ITU-R M.1231 and may be different for other systems.

NOTE 8 – In order to show the relationship between the long and short term margins, the interference criteria, the sharing criteria and the development of the associated power levels and time percentages, Figs. 1 and 2 have been prepared as an example for a narrow-band modulation with FDMA system. (Fig. 2 is also applicable to wideband modulation with DS-SSMA).

FIGURE 1

A power pyramid to assist in applying the methodologies contained in Recommendations ITU-R SA.1021, ITU-R SA.1022 and ITU-R SA.1023*



* This example uses the values calculated for the subscriber link in a reference bandwidth of 19.2 kHz for the narrow-band FDMA system

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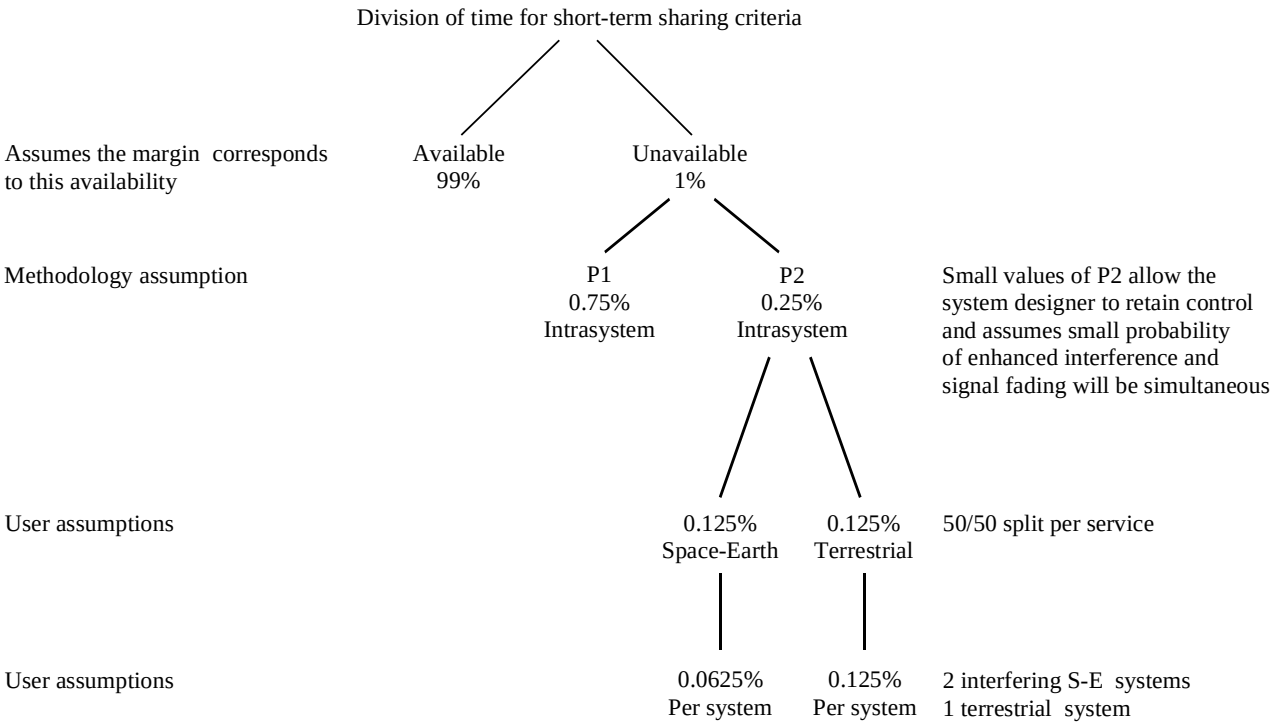
FIGURE 2

A power pyramid to assist in applying the methodologies contained in Recommendations ITU-R SA.1021, ITU-R SA.1022 and ITU-R SA.1023*



* This example uses the values calculated for the subscriber link in a reference bandwidth of 19.2 kHz for the narrow-band FDMA system.

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ANNEX 1

Basis of sharing criteria

1 Introduction

This Annex presents the parameters used in the implementation of Recommendation ITU-R SA.1023 using the interference criteria arrived at in Recommendation ITU-R M.1231. The permissible interference levels are subdivided into space and terrestrial categories of interfering signal paths and then into the number of anticipated interferers in each category. The basis for these allotments is shown in Table 2 and a discussion of the interference environment in each band is presented below.

2 Sharing criteria

The sharing criteria establishes a threshold, based on the interference criteria, on an individual interfering transmitter. The interference criteria is divided into interference powers for individual categories (e.g. space-based or terrestrial) and is then further sub-divided by the number of interferers to obtain a single-entry interference power threshold. After an assessment of potential interferers in the band of interest, the permissible level of interference (interference criteria) can be allocated to those interferers based on the service characteristics and usage of the band including geographic and time usage. For example, if a given frequency band is shared by one meteorological satellite and several mobile networks, it may be prudent to allocate 75% of the long-term interference to the meteorological-satellite service and 25% to the mobile service. A separate allocation can be made for the short-term criteria, when it is assumed that the link is not faded.

3 137-138 MHz band

The 137-138 MHz band is allocated to the space operation, meteorological-satellite, and space research services (space-to-Earth) on a primary basis. The MSS (space-to-Earth) is allocated on a primary basis in parts of the band and secondary in other parts. Fixed and mobile (except aeronautical mobile) services are allocated on a secondary basis.

For most of the time at a mobile-satellite earth stations, space stations could produce higher levels of interference than terrestrial stations. The gateway earth stations, with their higher gain and discrimination, can be expected to receive less interference from terrestrial stations than the mobile terminals. In the short-term, propagation enhancements on terrestrial paths and the location variability of mobile terminals may produce similar interference levels from space-to-Earth and terrestrial stations.

TABLE 2

Parameters used to derive sharing criteria

Frequency band (MHz)	Function and type of earth station	Short-term apportionment between categories of interferers		Long-term apportionment between categories of interferers		Equivalent number of short-term interferers		Equivalent number of long-term interferers	
Interfering signal path		Space-Earth path	Terrestrial path	Space-Earth path	Terrestrial path	Space-Earth path	Terrestrial path	Space-Earth path	Terrestrial path
137-138	Data downlink to gateway (15 or 16 dBi antenna)	50%	50%	80%	20%	2(1)	1	2(1)	1
137-138	Data downlink to subscriber terminal (0 dBi omni antenna)	50%	50%	70%	30%	2(1)	1	2(1)	1

(1) Usually this number reflects the anticipated number of single interfering transmitters. However, for this Recommendation, this number reflects the number of anticipated interfering constellations. Any limits or thresholds that would apply to a single spacecraft of one of these constellations would be handled during detailed and formal coordination.