

RECOMMENDATION ITU-R SA.1163-2

INTERFERENCE CRITERIA FOR SERVICE LINKS IN DATA COLLECTION SYSTEMS IN THE EARTH EXPLORATION-SATELLITE AND METEOROLOGICAL-SATELLITE SERVICES

(Question ITU-R 142/7)

(1995-1997-1999)

The ITU Radiocommunication Assembly,

considering

- a) that the hypothetical reference system specified in Recommendation ITU-R SA.1020 defines links for data collection, and data collection platform interrogation;
- b) that interference criteria are needed to ensure that systems can be designed to achieve adequate performance in the presence of interference;
- c) that the interference criteria may be determined using the methodology described in Recommendation ITU-R SA.1022 and the performance objectives listed in Recommendation ITU-R SA.1162;
- d) that interference criteria assists in the development of criteria for sharing bands among systems, including those operating in other services;
- e) that systems in the Earth exploration-satellite (including meteorological-satellite) service must accept an interference threshold at least as high as the threshold of permissible interference;
- f) that Annex 1 presents the parameters of representative systems that provide the basis for permissible levels of interference for pertinent transmissions in the Earth exploration-satellite service,

recommends

- 1 that the interference levels specified in Table 1 be used as the permissible total levels of interfering signal power at the antenna output of stations operating for service links in the Earth exploration-satellite and meteorological-satellite services.

TABLE 1

Interference criteria for service links of stations in the Earth exploration-satellite and meteorological-satellite services

Frequency band (MHz)	Function and type of earth station	Station subject to interference	Interfering signal power (dBW) in the reference bandwidth to be exceeded no more than 20% of the time	Interfering signal power (dBW) in the reference bandwidth to be exceeded no more than $p\%$ of the time
401-403 Earth-to-space	Non-GSO data collection, low-gain antenna	Space station	-178.8 dBW per 1 600 Hz ⁽¹⁾	-174.7 dBW per 1 600 Hz ⁽¹⁾ $p = 0.1$
137-138 space-to-Earth	Non-GSO data collection, command and data acquisition (CDA) station	Earth station	-158.3 dBW per 8.32 kHz ⁽¹⁾	-151.1 dBW per 8.32 kHz ⁽¹⁾ $p = 0.1$
401-403 Earth-to-space	GSO data collection, low-gain antenna	Space station	-187.4 dBW per 100 Hz ⁽²⁾	-173.4 dBW per 100 Hz ⁽³⁾ $p = 0.1$
1 670-1 690 space-to-Earth	GSO data collection, CDA station	Earth station	-194.0 dBW per 100 Hz ⁽²⁾	-181.5 dBW per 100 Hz ⁽³⁾ $p = 0.025$

TABLE 1 (end)

Frequency band (MHz)	Function and type of earth station	Station subject to interference	Interfering signal power (dBW) in the reference bandwidth to be exceeded no more than 20% of the time	Interfering signal power (dBW) in the reference bandwidth to be exceeded no more than $p\%$ of the time
2 025-2 110 Earth-to-space	GSO data collection, CDA station	Space station	-188.9 dBW per 100 Hz ⁽²⁾	-183.7 dBW per 100 Hz ⁽³⁾ $p = 0.025$
460-470 space-to Earth	GSO data collection platform interrogation	Earth station	-187.3 dBW per 100 Hz ⁽²⁾	-182.1 dBW per 100 Hz ⁽³⁾ $p = 0.1$

(1) The interfering signal powers (dBW) in the reference bandwidths are specified for reception at elevation angles $> 5^\circ$.

(2) The interfering signal powers (dBW) in the reference bandwidths are specified for reception at elevation angles $> 3^\circ$.

(3) The interfering signal powers (dBW) in the reference bandwidths are specified for reception at elevation angles $> 0^\circ$.

NOTE 1 – The total interfering signal power level that may be exceeded for no more than $x\%$ of the time, where x is less than 20% but greater than the specified short-term time percentage ($p\%$ of the time), 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 density (dB).

NOTE 2 – Although the interference criteria are based on the systems described in Annex 1, the interference criteria apply to all systems that operate in the subject frequency bands and which provide the specified service functions.

NOTE 3 – The interference criteria are specified with respect to the percentage of time of reception by the earth station. Thus, receiver performance statistics associated with reception from or by one particular satellite (i.e., cumulative distribution of bit error rate (BER)) are the same as the statistics for reception from several similar satellites. The total time of reception includes time periods associated with signal acquisition (i.e. before and during local ascension of the satellite), receiver synchronization to the data, and synchronized reception of data. Consequently, for interrogation by satellites in low-Earth orbit, the time required for initial signal acquisition and synchronization may constitute up to several tens of seconds out of total satellite visibility periods averaging on the order of 9 min. However, the analyses of short-term performance that are presented in Annex 1 (i.e., performance exceeded for all but a small percentage of time p , $p \leq 1\%$) assume that the satellite is located at the minimum elevation angle associated with the applicable performance objective. This yields the BER performance exceeded for all but $p\%$ of the time because E_b/N_0 and BER are monotonically related to elevation angle.

NOTE 4 – The elevation angle exceeded for all but 20% of the time during reception is well approximated by the angle exceeded for all but 20% of the time that the satellite is visible above the minimum elevation angle specified in the performance objective. This approximation is made in the performance analyses presented in Annex 1 because the underlying cumulative time error cannot exceed 1% (i.e. $p\%$ of the time) and the associated total error in satellite antenna gain, free space loss, excess path loss, and earth station parameter values are negligible. The resulting elevation angle that is exceeded for all but 20% of the time of reception yields the BER performance exceeded for all but 20% of the time because E_b/N_0 and BER are monotonically related to elevation angle.

NOTE 5 – Data collection platform interrogation from non-GSO satellites will be available in the near future.

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.

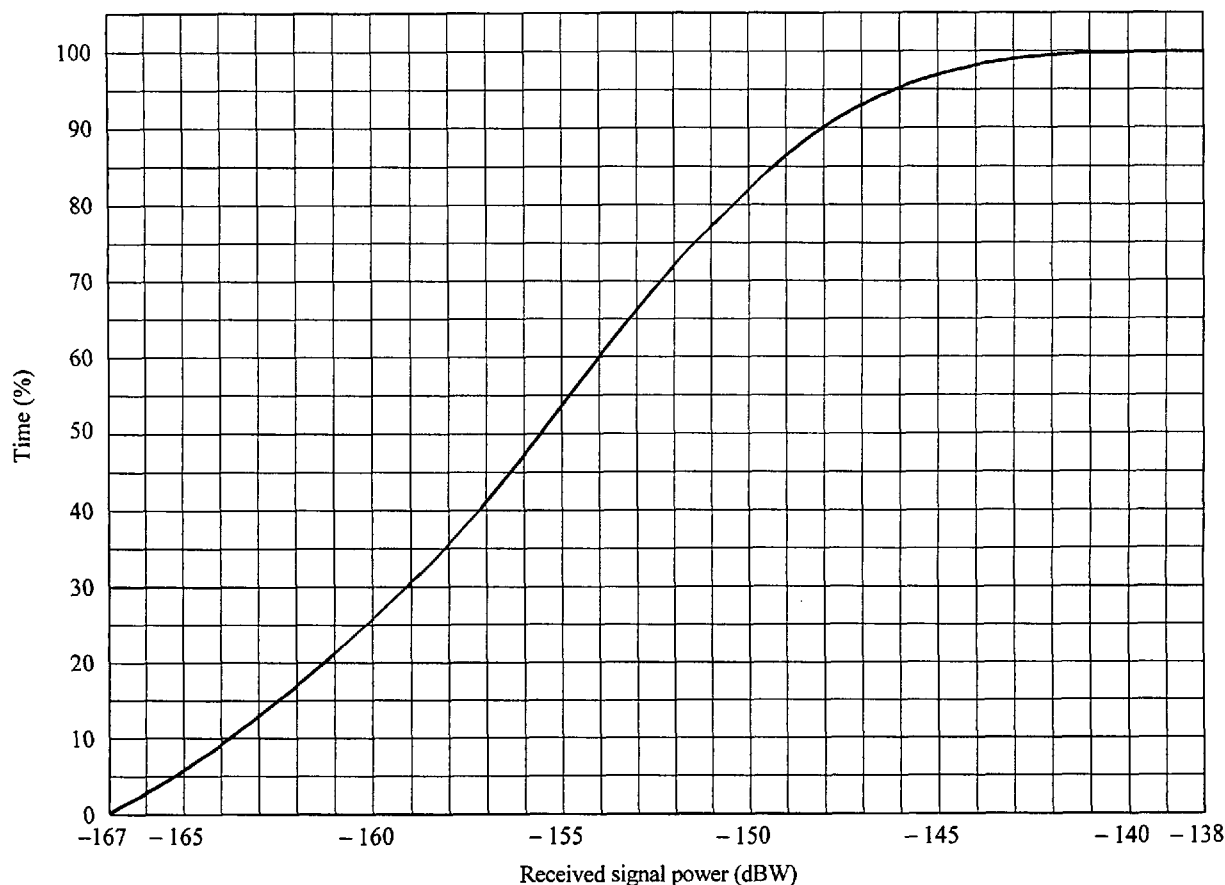
2 Meteorological-satellite service in the 401-403 MHz band uplink

2.1 ARGOS interfering criteria

The ARGOS data collection system (DCS) uplink (see Fig. 2) transmits split-phase, Manchester-encoded, phase-shift keyed (PSK) signals through satellites in low-Earth orbit and operates at a 400 bit/s data transmission rate. The data collection platform (DCP) typically uses a low-gain (5 dBi maximum at 20° elevation angle) antenna and can be a mobile or fixed platform.

The satellite DCS processor regenerates the uplink DCS data, multiplexes the data with other telemetry, and transmits the digital data to the ground in the 137-138 MHz band. Because of the DCS data regeneration in the satellite, downlink performance can be separated from uplink performance in deriving interference criteria. Figure 1 provides statistics of the ARGOS DCS uplink power measured at the satellite receiver. Table 2 provides the basis for developments of the ARGOS interference criteria.

FIGURE 1
ARGOS DCS uplink (measurements)



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