RECOMMENDATION ITU-R SA.1159-3

Performance criteria for data dissemination, data collection and direct data readout systems in the Earth exploration-satellite service and meteorological-satellite service

(Question ITU-R 141/7)

(1995-1997-1999-2006)

Scope

This Recommendation specifies the performance objectives for data dissemination, data collection and direct data readout systems of the Earth exploration-satellite service (EESS) and meteorological-satellite service (MetSat) operating either in low-Earth orbit (LEO) or in geostationary orbit.

The ITU Radiocommunication Assembly,

considering

a) that the hypothetical reference system specified in Recommendation ITU-R SA.1020 defines space-to-Earth links for direct readout of data acquisition of recorded data, as well as links for data dissemination, and direct data readout, data collection and data collection platform (DCP) interrogation by satellite;

b) that performance objectives for these transmissions must be consistent with the attendant functional requirements and with the performance limitations associated with the systems and frequency bands in which the requirements will be fulfilled;

c) that performance objectives for representative systems operating in the Earth exploration-satellite service (EESS) and meteorological-satellite service (MetSat) are intended to provide guidelines for the development of actual systems;

d) that performance objectives may be determined using the methodology described in Recommendation ITU-R SA.1021;

e) that the performance objectives are a prerequisite for the determination of interference criteria;

f) that Recommendation ITU-R SA.1627 contains the telecommunication requirements and characteristics of EESS and MetSat systems for data collection and their platform locations,

recommends

1 that links associated with data dissemination, data collection and direct data readout systems in the EESS and MetSat using satellites in low-Earth orbit (LEO) should have the performance objectives specified for the frequency bands in Table 1;

2 that links associated with data dissemination, data collection and direct data readout systems in the EESS and MetSat service using satellites in geostationary orbit should have the performance objectives specified for the frequency bands in Table 2;

TABLE 1

Performance objectives for links in the EESS and MetSat service using LEO satellites

Frequency band	Satellite service	Modulation	Applicable elevation angle (degrees)	Minimum *C*/*N* or maximum BER	Percentage of time (%)	Function and type of earth station
137-138 MHz (space-to-Earth)	MetSat	Analogue	≥ 25	10 dB	99.9	Direct data readout, low-gain antenna
	MetSat	Digital	≥ 5	10^{-6}	99.9	Direct data readout, tracking antenna
	MetSat	Digital	≥ 5	10^{-5}	99.6	CDA station, tracking antenna
400.15-401.00 MHz (space-to-Earth)	MetSat	Digital	≥ 5	10^{-6}	99.9	Direct data readout, low-gain antenna
401-403 MHz (Earth-to-space)	MetSat and EESS	Digital	≥ 5	10^{-5}	99.6	Data collection, low-gain antenna
460-470 MHz (space-to-Earth)	MetSat and EESS	Digital	≥ 5	10^{-5}	99.6	DCP interrogation, low-gain antenna DCP data, tracking antenna
1 670-1 710 MHz (space-to-Earth)	MetSat and EESS	Digital	≥ 5	10^{-3}	99.99	Direct data readout and recorded data acquisition, tracking antenna
		Digital	≥ 5	10^{-6}	99.9	
2 200-2 290 MHz (space-to-Earth)	EESS	Digital	≥ 5	10^{-6}	99.6	DCP data, Tracking antenna
7 750-7 850 MHz (space-to-Earth)	MetSat	Digital	≥ 5	10^{-3}	99.99	Recorded data acquisition, tracking antenna
	MetSat	Digital	≥ 5	10^{-6}	99.9	

TABLE 1 (*end*)

Frequency band	Satellite service	Modulation	Applicable elevation angle (degrees)	Minimum *C*/*N* or maximum BER	Percentage of time (%)	Function and type of earth station
8 025-8 400 MHz (space-to-Earth)	EESS	Digital	≥ 5	10^{-3}	99.99	Direct data readout and recorded data acquisition, tracking antenna
		Digital	≥ 5	10^{-6}	99.9	Recorded data acquisition, tracking antenna
		Digital	≥ 5	10^{-5}	99.0	Direct data readout, tracking antenna
25.5-27.0 GHz (space-to-Earth)	EESS	Digital	≥ 5	10^{-5}	99.9	Direct data readout and recorded data acquisition, tracking antenna

NOTE 1 – In Table 1, for the band 137-138 MHz, the elevation angle of 25° and other parameters for analogue receivers correspond with a level of performance that is guaranteed by designers of some systems. The parameters for the digital receivers correspond with user requirements.

NOTE 2 – The EESS is only allocated in the 1 690-1 710 MHz portion of the band.

NOTE 3 – Additional performance objectives could be specified for an availability of 99.99% of the time in relation to the need to synchronize the receiver to the data transmission frames and to avoid bit slips within a frame. However, for the purpose of deriving interference criteria, these objectives can be assumed to be met if the objectives associated with the above specified lower availability levels (Table 1) are met.

NOTE 4 – In all cases in Table 1, it is assumed that earth station sites are selected to yield average levels of environmental radio-frequency noise within the band. For direct data readout stations, which may be deployed in large numbers by various operating entities, there is a risk that randomly selected sites will exhibit higher than average levels of environmental noise (especially man-made noise) that may hamper the ability to achieve the stated performance objectives. However, the variance of this noise over all locations is not large in relation to receiver thermal noise, even at frequencies as low as 137-138 MHz, such that the performance objectives can generally be met at over 95% of the possible locations given link power margins of a few decibels. In the case of recorded data acquisition stations, sites are carefully selected to avoid ambient noise levels that exceed the average level.

TABLE 2

Performance objectives for links in the EESS and MetSat using geostationary orbits

Frequency band	Satellite service	Modulation	Applicable elevation angle (degrees)	Minimum *C/N* or maximum BER	Required time availability (%)	Function and type of earth station
401-403 MHz (Earth-to-space)	MetSat and EESS	Digital	≥ 3	10^{-5}	99.6	Data collection, Low-gain antenna
460-470 MHz (space-to-Earth)	MetSat and EESS	Digital	≥ 3	10^{-5}	99.6	DCP interrogation, low-gain antenna
1 670-1 710 MHz (space-to-Earth)	MetSat and EESS	Digital	≥ 3	10^{-6}	99.9	Direct data readout and data dissemination, high-gain antenna
		Analogue	≥ 3	10 dB	99.9	Data dissemination, high-gain antenna
		Digital	≥ 3	10^{-6}	99.6	CDA station, high-gain antenna
2 025-2 110 MHz (Earth-to-space)	EESS	Digital	≥ 3	10^{-5}	99.6	CDA station, high-gain antenna
7 450-7 550 MHz (space-to-Earth)	MetSat	Digital	≥ 5	10^{-6}	99.9	Direct data readout, high-gain antenna
18.1-18.3 GHz (space-to-Earth)	MetSat	Digital	≥ 5	10^{-7}	99.9	Direct data readout, high-gain antenna
25.5-27.0 GHz (space-to-Earth)	EESS	Digital	≥ 5	10^{-7}	99.9	Direct data readout, high-gain antenna

Notes to Table 2:

NOTE 1 – Performance objectives for specific systems may differ from the objectives presented in this Recommendation; however, the objectives defined herein are used as a basis for deriving permissible levels of interference that are the minimum interference thresholds to be accepted by specific systems.

NOTE 2 – Additional performance objectives could be specified for an availability of 99.99% of the time in relation to the need to synchronize the receiver to the data transmission frames and to avoid bit slips within a frame. However, for the purpose of deriving interference criteria, these objectives can be assumed to be met if the objectives associated with the above availability levels are met.

NOTE 3 – The EESS is only allocated in the 1 690-1 710 MHz portion of the band.

NOTE 4 – In all cases in Table 2, it is assumed that earth station sites are selected to yield average levels of environmental radio-frequency noise within the band. For direct data readout stations, which may be deployed in large numbers by various operating entities, there is a risk that randomly selected sites will exhibit higher than average levels of environmental noise (especially man-made noise) that may hamper the ability to achieve the stated performance objectives. However, the variance of this noise over all locations is not large in relation to receiver thermal noise, such that the performance objectives can generally be met at over 95% of the possible locations given link power margins of a few decibels.