

## RECOMMENDATION ITU-R SA.1160-1

**INTERFERENCE CRITERIA FOR DATA DISSEMINATION AND DIRECT  
DATA READOUT SYSTEMS IN THE EARTH EXPLORATION-SATELLITE AND  
METEOROLOGICAL-SATELLITE SERVICES USING SATELLITES  
IN THE GEOSTATIONARY ORBIT**

(Question ITU-R 141/7)

(1995-1997)

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 listed in Recommendation ITU-R SA.1159;
- 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 Earth exploration-satellite (EES) and meteorological-satellite (METSAT) services must specify interference thresholds at levels greater than or equal to the permissible levels;
- e) that Annex 1 presents the parameters of representative systems that provide the basis for permissible levels of interference for pertinent transmissions in the EES and METSAT services,

*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 in the EES and METSAT services.

TABLE 1

**Interference criteria for stations in the EES and METSAT services  
using spacecraft in the geostationary orbit**

Frequency band (MHz)	Function and type of earth station	Interfering signal power (dBW) in the reference bandwidth to be exceeded for no more than 20% of the time	Interfering signal power (dBW) in the reference bandwidth to be exceeded for no more than $p\%$ of the time
1 670-1 710	Direct data readout, high gain antenna	-150.7 dBW per 2.6 MHz	-150.1 dBW per 2.6 MHz $p = 0.025$
	Data dissemination, low gain antenna	-162.4 dBW per 4 kHz	-159.8 dBW per 4 kHz $p = 0.025$
	Data dissemination, high gain antenna	-145.3 dBW per 2.11 MHz	-144.7 dBW per 2.11 MHz $p = 0.025$
25 500-27 000	Direct data readout, 60.1 dBic antenna	-128 dBW per 10 MHz <sup>(1)</sup>	-119.1 dBW per 10 MHz <sup>(1)</sup> $p = 0.25$

*Notes to Table 1:*

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

NOTE 1 – The interfering signal powers (dBW) in the reference bandwidths are specified for reception at elevation angles  $\geq 3^\circ$ .

NOTE 2 – 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 3 – 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 4 – 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.

## ANNEX 1

**Basis for interference criteria**

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 for different types of transmission.

TABLE 2

**Downlink performance analysis used as a basis for interference criteria  
of stations operating with satellites in geostationary orbit**

Performance factor	Direct data readout		Data dissemination		Direct data readout	Direct data readout
Link function	Sensor data		High resolution data		Sensor data	Sensor data
Modulation type	QPSK	QPSK	BPSK	BPSK	Digital	Digital
Frequency range (MHz)	1 670-1 710	1 670-1 710	1 670-1 710	1 670-1 710	25 500-27 000	25 500-27 000
Time (%)	0.1	20	0.1	20	0.1	20
1. Transmitter output power (dBW)	3	3	10.7	10.7	9.0	9.0
2. Filter/cable line losses (dB)	2.9	2.9	2.9	2.9	---	---
3. Modulation losses (dB)	0.5	0.5	0.5	0.5	---	---
4. Antenna pointing error (dB)	0	0	0	0	0	0
5. Transmitter antenna gain (dBi)	16.5	16.5	16.5	16.5	41.8	41.8
6. Transmitter e.i.r.p. (dBW)	16.1	16.1	23.8	23.8	50.8	50.8
7. Antenna elevation angle (degrees)	3	3	3	3	5.0	5.0
8. Satellite altitude (km)	35 880	35 880	35 880	35 880	35 880	35 880
9. Free space loss (dB)	189.4	189.4	189.4	189.4	213.0	213.0
10. Excess path loss including rain attenuation (dB)	3	0	1	0	7.1	0
11. Receiver antenna gain (dBi)	45.1	45.1	39.5	39.5	60.1	60.1
12. Antenna pointing error (dB)	0.5	0.5	0.5	0.5	0.1	0.1
13. Receiver line loss (dB)	0	0	0	0	0	0
14. Polarization mismatch loss (dB)	0.2	0.2	0.2	0.2	0.1	0.1
15. Demodulator implementation loss (dB)	2.2	2.2	1.9	1.9	0.5	0.5
16. Data modulation loss (dB)	1	1	0	0	1.0	1.0
17. Received signal power (dBW)	-135.1	-132.1	-129.7	-128.7	-110.9	-103.8

TABLE 2 – (continued)

Performance factor	Direct data readout		Data dissemination		Direct data readout	Direct data readout
Link function	Sensor data		High resolution data		Sensor data	Sensor data
Modulation type	QPSK	QPSK	BPSK	BPSK	Digital	Digital
Frequency range (MHz)	1 670-1 710	1 670-1 710	1 670-1 710	1 670-1 710	25 500-27 000	25 500-27 000
Time (%)	0.1	20	0.1	20	0.1	20
18. Date rate (kbit/s)	2 600	2 600	2 110	2 110	15 000	15 000
19. Reference bandwidth (kHz)	2 600	2 600	2 110	2 110	10.1	10.1
20. Date rate (dB bit/s)	64.1	64.1	63.2	63.2	71.8	71.8
21. Received energy/bit, $E_b$ (dB(W/Hz))	-199.2	-196.2	-193.0	-192.0	-182.7	-175.6
22. Receiver system noise temperature (K)	117.5	117.5	269	269	715.4	715.4
23. Receiver noise spectral density (dB(W/Hz))	-207.9	-207.9	-204.3	-204.3	-200.1	-200.1
24. Total system $I + N$ power density (dB(W/Hz))	-207.9	-207.9	-204.3	-204.3	-200.1	-200.1
25. $E_b/N_0$ (dB)	8.7	11.7	11.4	12.4	17.4	24.5
26. Link bit-error ratio	$1 \times 10^{-6}$	$1 \times 10^{-6}$	$1 \times 10^{-6}$	$1 \times 10^{-6}$	$1 \times 10^{-7}$	$1 \times 10^{-7}$
27. Satellite data storage/handling error ratio	---	---	---	---	---	---
28. Total bit-error ratio	$1 \times 10^{-6}$	$1 \times 10^{-6}$	$1 \times 10^{-6}$	$1 \times 10^{-6}$	$1 \times 10^{-7}$	$1 \times 10^{-7}$
29. Required $E_b/N_0$	10.8	10.8	10.8	10.8	10.5	10.5
30. Margin	-2.1	0.9	0.6	1.6	6.9	14.0
Long-term or short-term margin (dB)	0.9	-2.1	1.6	0.6	14.0	6.9
Interference power (dBW)	-150.1	-150.7	-144.7	-145.3	-119.1	-128.0

TABLE 3

**Downlink performance analysis used as a basis for interference criteria of small earth stations operating with satellites in geostationary orbit**

Performance factor	Data dissemination	
Link function	WEFAX	
Modulation type	FM	FM
Frequency range (MHz)	1 670-1 710	1 670-1 710
Time (%)	0.1	20
1. Transmitter output power (dBW)	6.7	6.7
2. Filter/cable line losses (dB)	2.9	2.9
3. Modulation losses (dB)	0	0
4. Antenna pointing error (dB)	0	0
5. Transmitter antenna gain (dBi)	15.0	15.0
6. Transmitter e.i.r.p. (dBW)	18.8	18.8
7. Antenna elevation angle (degrees)	3	3
8. Satellite altitude (km)	35 880	35 880
9. Free space loss (dB)	189.4	189.4
10. Excess path loss including rain attenuation (dB)	0.4	0
11. Receiver antenna gain (dBi)	25.6	25.6
12. Antenna pointing error (dB)	0	0
13. Receiver line loss (dB)	2	2
14. Polarization mismatch loss (dB)	0.2	0.2
15. Demodulator implementation loss (dB)	0	0
16. Data modulation loss (dB)	0	0
17. Received signal power (dBW)	-147.6	-147.2
18. Necessary bandwidth (kHz)	18	18
19. Reference bandwidth (kHz)	4	4
20. Signal bandwidth (dB/Hz)	36.0	36.0
21. Received power density $C_0$ (dB(W/Hz))	-183.6	-183.2
22. Receiver system noise temperature (K)	1 585	1 584
23. Receiver noise spectral density (dB(W/Hz))	-196.6	-196.6
24. Total system $I + N$ power density (dB(W/Hz))	-196.6	-196.6
25. $C_0/N_0$ (dB)	13.0	13.4
26. Link bit-error ratio	---	---
27. Satellite data storage/handling error ratio	---	---
28. Total bit-error ratio	---	---
29. Required $C_0/N_0$	10	10
30. Margin	3.0	3.4
Long-term or short-term margin (dB)	3.4	3.0
Interference power (dBW)	-159.8	-162.4