RECOMMENDATION ITU-R F.1248[*, **]

Limiting interference to satellites in the space science services from the emissions of trans-horizon radio-relay systems in the bands 2 025-2 110 MHz and 2 200-2 290 MHz

(Questions ITU-R 118/7 and ITU-R 113/9)

(1997)

The ITU Radiocommunication Assembly,

considering

a) that the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos, 1992) (WARC-92) added on a co-primary basis with existing fixed and mobile services, allocations to the space research, space operation and Earth exploration-satellite services (space science services) in the bands 2 025-2 110 MHz and 2 200-2 290 MHz;

b) that trans-horizon radio-relay systems may operate in the bands 2 025-2 110 MHz and 2 200-2 290 MHz;

c) that Recommendation ITU-R F.698 addresses the general problems of sharing between the space services and trans-horizon radio-relay systems;

d) that No. 21.7 of the Radio Regulations (RR) notes the difficult sharing conditions with trans-horizon radio-relay systems and urges administrations to keep to a minimum the number of trans-horizon systems in certain bands, including the bands 2 025-2 110 MHz and 2 200-2 290 MHz;

e) that limits on the emissions of trans-horizon radio-relay systems are required in order to prevent harmful interference to space science services satellites operating in the bands stated in § a),

recommends

1 that in the band 2 025-2 110 MHz, the power spectral density at the input to the transmitting antenna of a trans-horizon radio-relay system (except for existing systems on existing routes) should not exceed 6 dB(W/MHz) in order to satisfy the sharing criteria set forth in Recommendation ITU-R SA.1274 (see Note 1 and Annex 1);

2 that in the band 2 200-2 290 MHz, the e.i.r.p. spectral density of the emission of a trans-horizon radio-relay system (except for existing systems on existing routes) should conform to the values and conditions given in Recommendation ITU-R F.1247 (see Note 1);

3 that this Recommendation provides the latest information prepared by the ITU-R as referred to in *recommends* 1 of Recommendation 100 (Rev.WRC-95) (see Note 2).

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[*] This Recommendation was developed jointly by Radiocommunication Study Groups 7 and 9, and any future revision should also be undertaken jointly.

[**] Radiocommunication Study Group 9 made editorial amendments to this Recommendation in 2004.

NOTE 1 – For the purpose of this Recommendation, an existing system on an existing route is regarded as one already planned before the closure of the ITU Radiocommunication Assembly (Geneva, 1997) and brought into service before 1 January 2000.

NOTE 2 – Recommendation 100 (Rev.WRC-95), in its *recommends* 1, states that administrations for the assignment of frequencies to new stations in systems using tropospheric scatter, take into account latest information prepared by ITU-R to ensure that systems established in the future use a limited number of certain frequency bands.

Annex 1

Statistics of interference to low-orbiting satellites from the emissions of a single trans-horizon radio-relay station in the band 2 025-2 110 MHz

1 Introduction

This Annex summarizes the results of computer simulations to determine the statistics of interference to low-orbiting satellites from the emissions of a single trans-horizon radio-relay station. Several cases were evaluated. In a typical case, a single trans-horizon station was located at a specified latitude. The antenna was positioned at an elevation angle of 1° and at an azimuth angle of 0 to 350° in 10° steps. Interference to a low-orbiting satellite for each azimuth angle of the trans-horizon station transmitting antenna was calculated in 3 s increments over a simulated period of 30 days. The output of the simulation was the cumulative probability of interference as a function of interference power density level. The major parameters used in the simulations are listed in Table 1.

TABLE 1

Summary of the parameters used in the simulations

Trans-horizon station	Value
Transmitter power density (dB(W/MHz))	21.3
Antenna gain (dBi)	45
Reference radiation pattern	Recommendation ITU-R F.1245
Elevation angle (degrees)	1
Azimuth angle (degrees)	0-350
Azimuth angle step size (degrees) – Station latitude (degrees) – Station latitude (degrees)	10 10 40
Low-orbiting satellite – Altitude/inclination (km/degrees) – Altitude/inclination (km/degrees)	 800/98.6 350/57.1
Receiving antenna gain (dBi)	0
Sharing criteria Recommendation ITU-R SA.1274	 < –147 dB(W/MHz), 0.1%
Simulation – Duration (days) – Time step (s) – Operating frequency (MHz)	 30 3 2 050

2 Results

Results were obtained for a satellite in an orbit that is characteristic of Earth observing satellites (an altitude of 800 km inclined by 98.6° with respect to the equatorial plane) and for a satellite in an orbit that is typical of the international space station (an altitude of 350 km inclined by 57.1° with respect to the equatorial plane). The results are given in Figs. 1 through 4. Each curve in the figure corresponds to a particular azimuth angle of the trans-horizon transmitting antenna.

Figure 1 shows that the level of interference at the 0.1% criterion given in Recommendation ITU-R SA.1274 is exceeded by about 7 dB. Similarly, Figs. 2, 3 and 4 show that the interference level at the 0.1% criterion is exceeded by about 10 dB, 11 dB and 16 dB, respectively. Thus, the power spectral density at the input to the antenna of a trans-horizon radio-relay station needs to be reduced by about 15 dB from the value of 21.3 dB(W/MHz) used in the simulations to a value of 6 dB(W/MHz).

FIGURE 1

Probability of interference to a low-orbiting satellite in an 800 km orbit inclined by 98.6° from a trans-horizon station with different azimuth angles located at 10° latitude

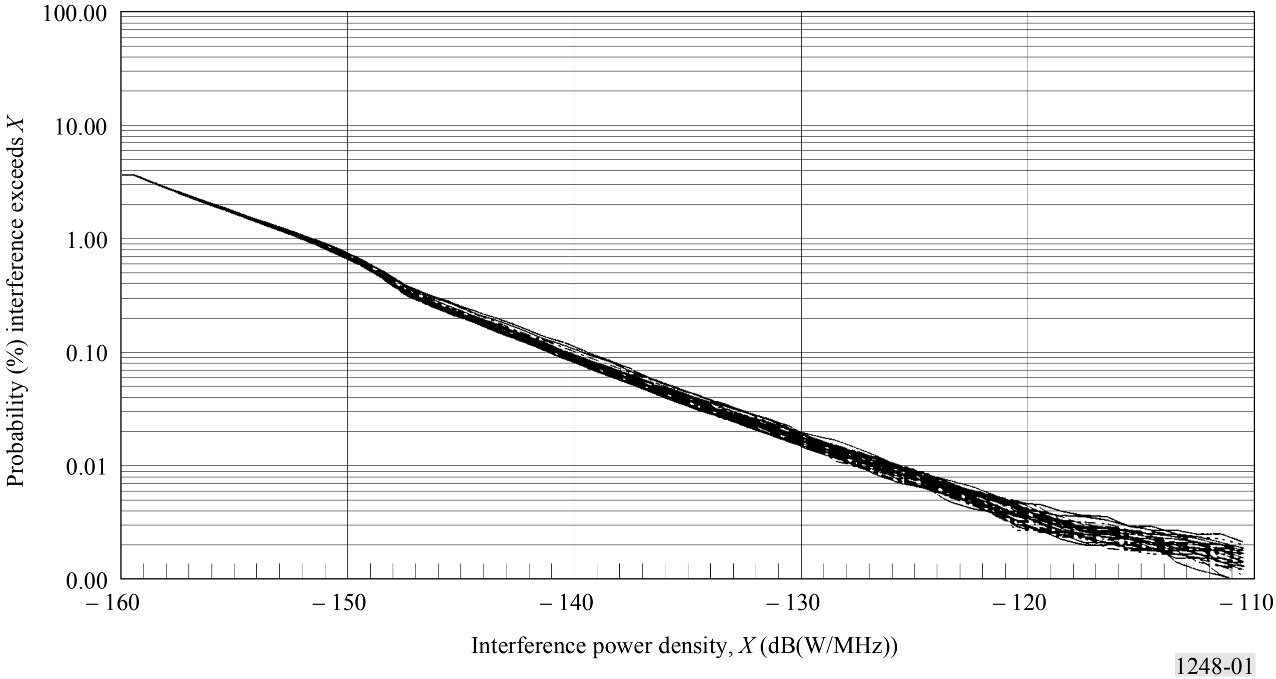


FIGURE 2

Probability of interference to a low-orbiting satellite in an 800 km orbit inclined by 98.6° from a trans-horizon station with different azimuth angles located at 40° latitude

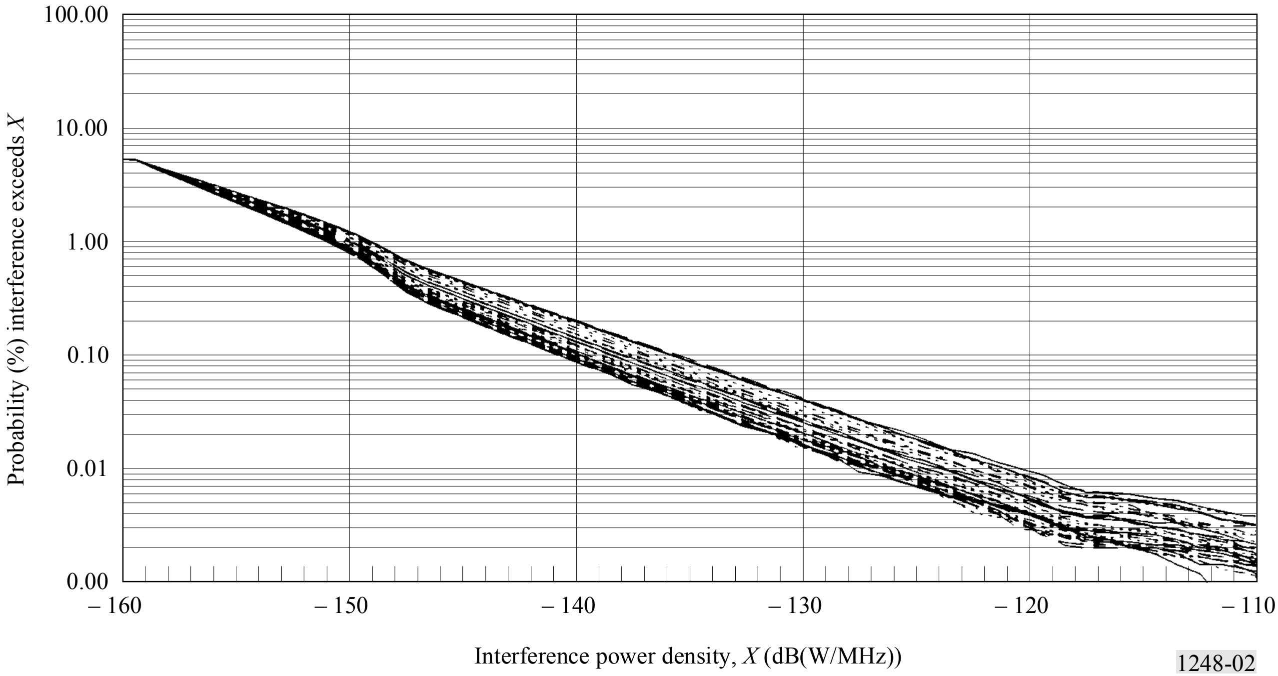


FIGURE 3

Probability of interference to a low-orbiting satellite in a 350 km orbit inclined by 57.1° from a trans-horizon station with different azimuth angles located at 10° latitude

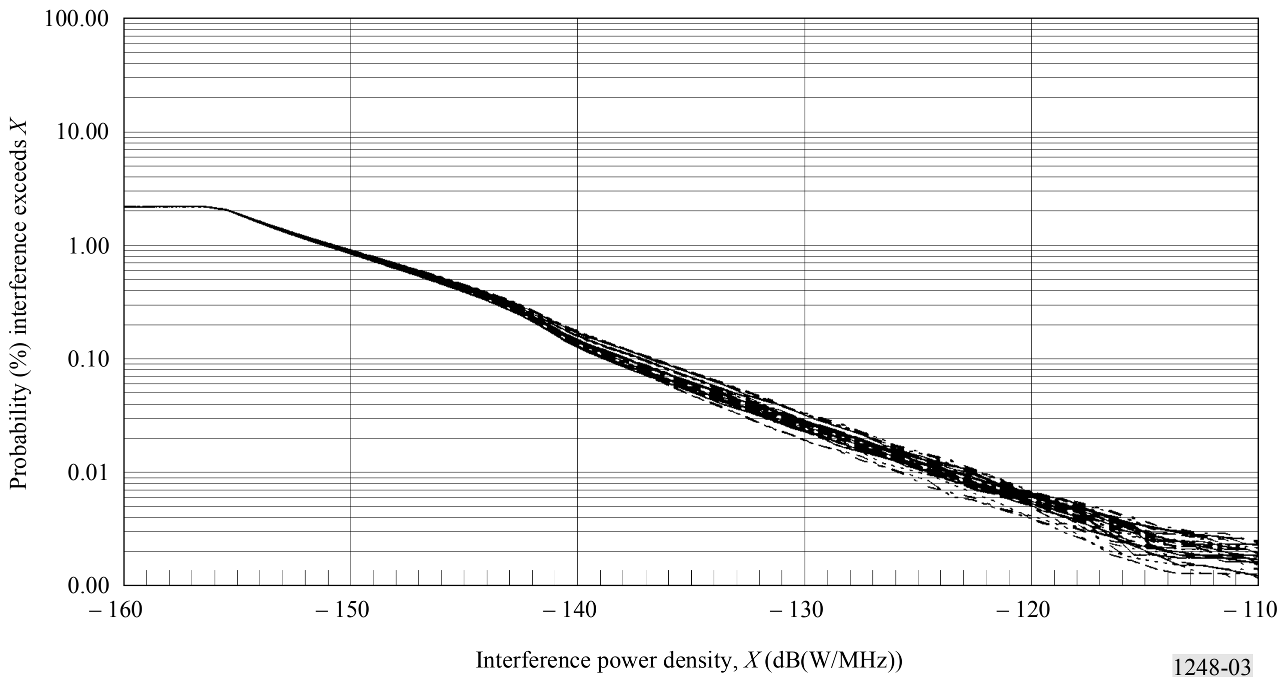
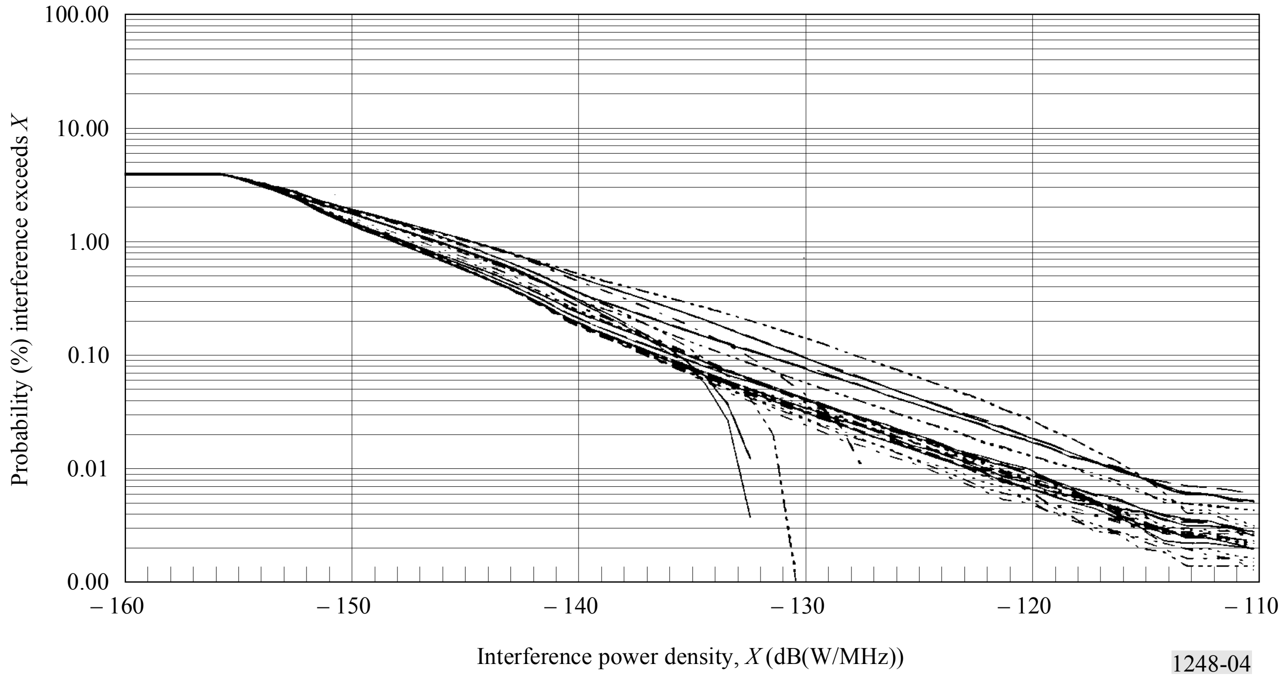


FIGURE 4

Probability of interference to a low-orbiting satellite in a 350 km orbit inclined by 57.1° from a trans-horizon station with different azimuth angles located at 40 ° latitude



3 Summary and conclusions

For the case of a single trans-horizon radio-relay system interfering with low-orbiting satellites in the band 2 025-2 110 MHz, it was found that the power spectral density at the input to the transmitting antenna should be limited to a value on the order of 6 dB(W/MHz). An appropriate reduction in this value should be made if there are more than one co-channel trans-horizon system on the surface of the Earth.