

RECOMMENDATION ITU-R F.1246*

**REFERENCE BANDWIDTH OF RECEIVING STATIONS IN THE FIXED SERVICE
TO BE USED IN COORDINATION OF FREQUENCY ASSIGNMENTS WITH
TRANSMITTING SPACE STATIONS IN THE MOBILE-SATELLITE
SERVICE IN THE 1-3 GHz RANGE**

(Questions ITU-R 201/8 and ITU-R 118/9)

(1997)

The ITU Radiocommunication Assembly,

considering

- a) that several frequency bands in the 1-3 GHz range are shared between the mobile-satellite (space-to-Earth) service and the fixed service (FS);
- b) that networks in the mobile-satellite service (MSS) will generally use digital modulation and frequency division multiple access (FDMA), time division multiple access (TDMA) or code division multiple access (CDMA) access techniques, which will result in relatively uniform spectral shape in the allocated bandwidth of the MSS carrier;
- c) that most MSS networks, according to Radio Regulation (RR) Appendix 4 data, use narrow-band modulation techniques such that several channels in these networks could be encompassed in a 1 MHz reference bandwidth for systems in the FS and that these channels are also usually subject to voice activated channel loading and active power control in order to reduce the effective power resource requirements on the MSS satellite;
- d) that in order to accommodate the worst potential case for interference to the FS, coordination threshold levels of power flux-density have been specified in Recommendations ITU-R IS.1141 (Geneva, 1995) and ITU-R IS.1142 (Geneva, 1995) for 4 kHz reference bandwidth;
- e) that use of a relatively large reference bandwidth for receivers in the FS enables consideration of the actual types of digital modulation and access schemes used for space-to-Earth transmissions from space stations in the MSS, which can reduce the effective level of expected interference;
- f) that digital systems should generally be used as the reference model for interference calculations in the 1-3 GHz range,

recommends

- 1** that a 1 MHz reference bandwidth should be used for analogue and digital systems in the FS for coordination thresholds of power flux-density and fractional degradation in performance of MSS systems in the MSS space-to-Earth allocations in the 1-3 GHz range (see Notes 1, 2, 3 and 4);
- 2** that a 4 kHz reference bandwidth should be also used for analogue FDM-FM systems in the FS for coordination thresholds of power flux-density for MSS systems in the MSS space-to-Earth allocations in the 1-3 GHz range (see Notes 1, 3 and 4).

NOTE 1 – The reference bandwidths in § 1 and 2 form a basis of the coordination threshold values of power flux-density and fractional degradation in performance recommended in Recommendations ITU-R M.1141 and ITU-R M.1142.

NOTE 2 – Use of a 1 MHz reference bandwidth is consistent with the protection of digital systems (see Annex 1).

* This Recommendation was developed jointly by Radiocommunication Study Groups 8 and 9, and any future revision will also be undertaken jointly.

NOTE 3 – In cases where MSS carrier spectrum is uniform across its occupied bandwidth and is not highly concentrated in any narrow spectral range within the reference bandwidth, use of a 1 MHz reference bandwidth is generally consistent with protection of analogue systems (see Annex 1).

NOTE 4 – Use of both a 1 MHz and 4 kHz reference bandwidth would be consistent with the protection of analogue FDM-FM systems, since the use of the 4 kHz reference bandwidth limits the peak power spectral density of narrow-band interfering MSS carriers.

If the coordination threshold applicable to a 1 MHz reference bandwidth is X dB(W/m²), the additional coordination threshold appropriate for a 4 kHz reference bandwidth is $X - 18$ dB(W/m²) (see Annex 1). For analogue systems in the FS carrying television, it is not necessary to apply the coordination threshold employing a 4 kHz reference bandwidth.

This new approach of employing both 1 MHz and 4 kHz reference bandwidths in specifying coordination threshold levels is applicable only to the frequency bands in the 1-3 GHz range shared by the MSS and the FS. This result is based on the fact that the analogue systems in the FS in these bands are generally used for low to medium capacity of 960 channels or less. This new approach is not appropriate for other frequency bands where high-capacity analogue radio-relay systems are employed. (The power flux-density limit for the fixed-satellite service in the 6 825-7 075 MHz band also adopts both 1 MHz and 4 kHz reference bandwidths (see RR Table S21-4), but it was decided on the basis of a reason which is outside the scope of this Recommendation.)

NOTE 5 – Annex 2 contains information on the characteristics of digital narrow-band MSS carriers and the benefits the use of a 1 MHz reference bandwidth would have in the coordination of MSS satellite networks with fixed networks. Detailed information concerning the spectral characteristics of MSS carriers operating in the space-to-Earth direction in the 1-3 GHz range can be found in RR Appendix 3 data filed with the Radiocommunication Bureau for planned MSS networks.

ANNEX 1

Reference bandwidth for systems in the fixed service in frequency sharing with the mobile-satellite service

1 Introduction

Recommendations ITU-R M.1141 and ITU-R M.1142 contain coordination thresholds for systems in the fixed service in frequency sharing with the MSS. The World Radiocommunication conference (Geneva, 1995) (WRC-95) incorporated these coordination thresholds into the revised RR.

This Annex provides some comments on the reference bandwidth adopted in the above ITU-R Recommendations.

2 Reference bandwidth for digital systems in the FS

Recommendation ITU-R IS.1141 (Geneva, 1995) adopts a 1 MHz reference bandwidth for defining fractional degradation in performance (FDP) of digital systems in the FS with respect to frequency sharing with non-geostationary-satellite orbit (GSO)/MSS space stations (except for the band 2 483.5-2 500 MHz). However, Recommendation ITU-R IS.1142 (Geneva, 1995) adopts a 4 kHz reference bandwidth for defining the coordination thresholds, in terms of power flux-density, for digital systems in the FS with respect to frequency sharing with GSO/MSS space stations.

The above inconsistency should be resolved. In general, it seems adequate to adopt the 1 MHz reference bandwidth to protect digital FS systems.

In some applications, digital FS systems may employ a relatively small bandwidth and such systems may prefer a smaller reference bandwidth. But attention should be drawn to the fact that MSS systems generally operate in digital modulation (e.g. QPSK) in which spectra are uniform over a certain bandwidth. Therefore, even if a 1 MHz reference bandwidth is adopted, there is little danger in protecting digital FS systems with a smaller bandwidth.

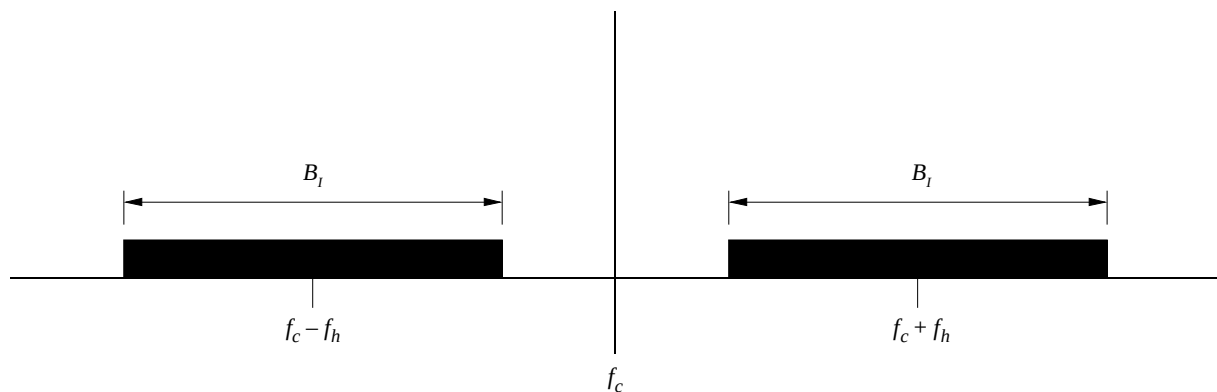
3 Reference bandwidth for analogue systems in the FS

3.1 Interference assessment in case of two interference entries

Traditionally, a 4 kHz reference bandwidth has been adopted for specifying sharing criteria for analogue FS systems. It is particularly appropriate in specifying sharing criteria for high-capacity analogue radio-relay systems. However, in the 1-3 GHz range, analogue FS systems are generally of medium or low capacity. In such case, the effect of interference is less than that in case of high-capacity systems, because a greater energy dispersion effect through the FM demodulation process can be expected at a lower capacity.

In order to estimate such effect, calculations were made for a FS radio-relay system carrying 960 channel telephony (baseband: 60-4028 kHz). The 960 channel capacity was chosen for the calculations because it is the highest capacity generally used in the 1-3 GHz range, thus representing a worst case analysis. The interference was assumed to be as shown in Fig. 1, that is, two interference signals (each with bandwidth of B_I) appear with the centre frequencies $f_c + f_h$ and $f_c - f_h$ where f_c is the radio carrier frequency and f_h is the highest baseband frequency. The calculation method is presented in Appendix 1 to Annex 1.

FIGURE 1
Interference situation



f_c : carrier frequency of the FS system

f_h : highest baseband frequency of the FS system

B_I : bandwidth of the interference signal

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The results are shown in Fig. 2. $B_I = 8$ MHz corresponds to the case of an interfering signal of very wide bandwidth (similar to thermal noise). The baseband interference level at f_h ($= 4028$ kHz) for $B_I = 8$ MHz is taken as 0 dB. The baseband interference in the range of 2-4 MHz is almost constant due to pre-emphasis effect.