RECOMMENDATION ITU-R M.1654*

A methodology to assess interference from broadcasting-satellite service (sound) into terrestrial IMT-2000 systems intending to use the band 2 630-2 655 MHz

(Question ITU-R 229/8)

(2003)

Summary

This Recommendation is an example methodology to assess the interference from BSS (sound) into terrestrial IMT-2000 systems intending to use the band 2 630-2 655 MHz and that could be used to determine the impact of BSS (sound) on terrestrial IMT-2000 in the context of co-frequency sharing through the development of pfd masks, where applicable. This methodology contains an algorithm that can be used to calculate a single entry pfd mask for BSS (sound) satellites for a given scenario to meet an *Isat*/*Nth* criterion within a tolerance of 1 dB at any location on the Earth. Attachment 1 to Annex 1 sets out an example of the application of a methodology assessing the possible impact in terms of a loss of coverage or cell size reduction. It has been recognized that the interference into a cellular network can be assessed in terms of coverage reduction (particularly in noise-limited networks such as in rural areas) as well as in terms of availability reduction (particularly in capacity-limited networks such as in urban areas). These approaches may be complementary, and additional study is required on these further aspects. Further study is required on alternative example methods assessing the possible impact. The use of this Recommendation to calculate pfd values in the context of co-frequency sharing should carefully take into account all parameters including operational constraints on BSS (sound) systems, as well as the likely different IMT-2000 sharing scenarios. In particular, it should be noted that if this Recommendation is used to derive pfd values to be applied as hard limits, worst-case assumptions are not deemed appropriate. As this Recommendation contains a methodology for assessing multiple satellite interference, its use is not advised in the process of coordination.

The ITU Radiocommunication Assembly,

considering

a) that a methodology is required to assess the possible aggregate interference from BSS (sound) into terrestrial IMT-2000 systems intending to use the band 2 630-2 655 MHz and for the development of pfd masks, where applicable, with a view to achieving the objectives in Resolutions 223 (WRC-2000) and 539 (WRC-2000),

* NOTE – The following countries – Saudi Arabia, Djibouti, Egypt, United Arab Emirates, Jordan, Kuwait, Morocco, Mauritania, Syrian Arab Republic, Tunisia and Yemen – object to the approval of this Recommendation and are not bound by it.

recognizing

a) that Resolution 539 (WRC-2000), *inter alia*, contains provisional pfd threshold levels for BSS (sound) systems using non-GSO satellites in the band 2 630-2 655 MHz;

b) that Resolution 539 (WRC-2000) invites ITU-R to conduct the necessary technical studies in time for WRC-03 relating to frequency sharing between systems in the BSS (sound) and terrestrial services in the band 2 535-2 655 MHz with a view to avoid placing undue constraints on either service,

recommends

1 that the example methodology described in Annex 1 of this Recommendation could be used to assess interference from, and possible impact of, BSS (sound) on terrestrial IMT-2000 systems intending to use the band 2 630-2 655 MHz in the context of co-frequency operation through the development of pfd masks.

NOTE 1 – The example methodology described in Annex 1 of this Recommendation may also be applied for assessing interference of co-frequency operation involving any satellite service system using various orbital configurations, including the geostationary orbit or highly elliptical orbit types.

Annex 1

A methodology to assess interference from BSS (sound) into terrestrial IMT-2000 systems intending to use the band 2 630-2 655 MHz

1 Input data and scenarios

1.1 Characteristics of the systems

A given scenario will consist of BSS (sound) satellite networks using non-GSO space stations employing highly-elliptical orbits (HEO) and/or space stations using the GSO interfering into terrestrial IMT-2000 systems (base and/or mobile stations). Sections 1.1.1[1] and 1.1.2 list the necessary parameters, respectively for terrestrial IMT-2000 stations and BSS (sound) systems, to assess aggregate interference from BSS (sound) to terrestrial IMT-2000 stations.

1.1.1 Terrestrial IMT-2000 stations

– Receiver characteristics:
  – thermal noise level;
  – noise factor.

[1] Additional system specific input parameters for terrestrial IMT-2000 stations would be required for usage of Methods 2a and 2b in § 3.1.2. The detailed list of these parameters is provided in Attachment 1.

– Antenna characteristics:
  – maximum gain;
  – polarization;
  – feed loss;
  – 3 dB beamwidth[2];
  – vertical and azimuthal antenna radiation patterns over a range of elevation angles[2];
  – downtilt of the antenna[2];
  – site sectorization[2].
– Location of the receivers (for example, an area bounded by latitude(s) and longitude(s) data).

1.1.2 BSS (sound) systems

The various combination of a constellation of BSS (sound) systems that could operate in the 2 630-2 655 MHz band should be in accordance with the expected number of co-frequency satellites visible at the same location on the surface of the Earth. These may include non-GSO and/or GSO satellites.

– GSO satellites, assumed equally spaced across the GSO arc:
  – nominal geographical longitude on the geostationary satellite orbit.
– For non-GSO HEO satellite systems, the following parameters are to be provided:
  – number of orbital planes, number of space stations per orbital plane and number of space stations simultaneously transmitting on the active arc, period of the space stations;
  – altitude and longitude of the apogee and perigee for each space station;
  – inclination angle for each orbital plane with respect to Earth equatorial plane;
  – start and end of the active arc for each space station.

Interference produced by BSS (sound) satellites is typically modelled by pfd masks as a function of elevation angle (dB(W/(m^2 · MHz)))[3]. Information on the polarization used by the satellite transmitters would be required to assess polarization discrimination if needed (see factor P_i in equations (1) and (2) in § 3.1.1).

There are two approaches to the analysis. These are:

– static approach – the location of the satellite is fixed at a single point;
– orbital simulation approach – time variation of the satellite is included[4].

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[2] Only applies to base station receivers.

[3] The modelling by this method may result in a worst-case situation of interference from GSO BSS (sound) satellites.

[4] It is considered that this approach, while requiring more complex simulation tools, will produce more accurate results.