International Telecommunication Union

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R BO.1898

(01/2012)

# Power flux-density value required for the protection of receiving earth stations in the broadcasting-satellite service in Regions 1 and 3 from emissions by a station in the fixed and/or mobile services in the band 21.4-22 GHz

BO Series

Satellite delivery

## Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

## Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from http://www.itu.int/ITU-R/go/patents/en where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

### Series of ITU-R Recommendations

(Also available online at http://www.itu.int/publ/R-REC/en)

| Series | Title |
|---|---|
| **BO** | **Satellite delivery** |
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| **BS** | Broadcasting service (sound) |
| **BT** | Broadcasting service (television) |
| **F** | Fixed service |
| **M** | Mobile, radiodetermination, amateur and related satellite services |
| **P** | Radiowave propagation |
| **RA** | Radio astronomy |
| **RS** | Remote sensing systems |
| **S** | Fixed-satellite service |
| **SA** | Space applications and meteorology |
| **SF** | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| **SM** | Spectrum management |
| **SNG** | Satellite news gathering |
| **TF** | Time signals and frequency standards emissions |
| **V** | Vocabulary and related subjects |

***Note***: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.*

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RECOMMENDATION ITU-R BO.1898

# Power flux-density value required for the protection of receiving earth stations in the broadcasting-satellite service in Regions 1 and 3 from emissions by a station in the fixed and/or mobile services in the band 21.4-22 GHz

(2012)

## Scope

This Recommendation provides the maximum permissible pfd value to protect receiving earth stations in the BSS in Regions 1 and 3 from emissions generated by a single station in the fixed and/or mobile services in the band 21.4-22.0 GHz. It is intended to be used as guidance to administrations in their bilateral or multilateral negotiations by providing the detailed methodology and the derived pfd value.

The ITU Radiocommunication Assembly,

*considering*

a) that emissions from terrestrial stations may produce interference exceeding permissible levels into receiving earth stations in the BSS in Regions 1 and 3 in the band 21.4-22.0 GHz;

b) that in order to protect BSS receiving earth stations in Regions 1 and 3 from unacceptable interference of terrestrial stations, an appropriate maximum permissible pfd value applicable to emissions from a terrestrial station in this band needs to be determined,

*recommends*

**1** that, in order to protect BSS receiving earth stations, a value of –120.4 dB(W/(m$^2$·1 MHz)) should be used as the single-entry maximum permissible level of the pfd produced by emissions from a terrestrial station in the band 21.4-22.0 GHz;

**2** that this value should not be exceeded at 3 m above the ground at any point of the territory of any other administrations in Regions 1 and 3 for more than 20% of the time, calculated in accordance with Recommendation ITU-R P.452-14;

**3** that the following Notes should be considered as part of this Recommendation.

NOTE 1 – The pfd value in *recommends* 1 was derived using the methodology contained in Annex 1.

NOTE 2 – The single entry pfd in *recommends* 1 is derived from an aggregate $I/N$ = –12.2 dB (corresponding to a 6% increase of the equivalent system noise temperature), assuming an equivalent number of 3.3 interfering sources, each transmitting at maximum single entry pfd.

NOTE 3 – The value in *recommends* 1 is derived under the assumption that the minimum angle between the direction of maximum antenna gain of the BSS earth station and the direction to the interfering transmitter is 10 degrees.

NOTE 4 – The value in *recommends* 1 may be used either as a hard limit or a threshold value to ensure protection of the broadcasting-satellite network in Regions 1 and 3 from a terrestrial station, as appropriate.

# Annex 1

## Methodology and assumptions to calculate the maximum permissible power flux-density value required for the protection of the BSS receiving earth stations in Regions 1 and 3, from emissions by a terrestrial station in the band 21.4-22.0 GHz

In order to protect the BSS receiving earth station, the maximum permissible power flux-density (pfd) value produced by emissions from a terrestrial station in the band 21.4-22.0 GHz is given by the equation:

$$PFD_n = P_n + (I/N) - S(\varphi_{min}) \quad (1)$$

where:

$PFD_n$: maximum permissible pfd value for a single terrestrial station (dB(W/(m$^2$·1 MHz)));

$P_n = kT \times (10^6)$: BSS receiving earth station noise power (dB(W/1 MHz));

$S(\varphi_{min})$: BSS receiving earth station antenna-effective area (dBm$^2$).

The total BSS receiving earth station noise temperature (including antenna noise) is assumed as 140 K. Therefore, the noise power, $P_n$, for the BSS receiving station is calculated as follows;

$$P_n = -228.6 + 10\log(140) + 10\log(10^6) = -147.1 \text{ dB(W/1 MHz)} \quad (2)$$

The permissible $I/N$ ratio from a single terrestrial station is assumed as –17.4 dB[1].

$S(\varphi_{min})$ is defined by the following equation:

$$S(\varphi_{min}) = G(\varphi_{min}) + 10\log(\lambda^2/4\pi) \quad (3)$$

where $G(\varphi_{min})$ is BSS receiving earth station antenna gain in the direction $\varphi_{min}$ from the axis of the main beam and in a corresponding range of $\varphi_{min}$ values, the antenna gain is equal to:

$$G(\varphi_{min}) = 29 - 25\log(\varphi_{min}) = 4 \text{ dBi} \quad (4)$$

where the minimum angle between the direction of maximum antenna gain of the BSS earth station and the direction to the interfering transmitter, $\varphi_{min}$, for the broadcasting-satellite network in the band 21.4-22.0 GHz is assumed as 10 degrees.

Then, $S(\varphi_{min})$ = –44.2 dBm$^2$ (at 21.7 GHz).

Using these values above and equation (1), the maximum permissible single entry $PFD_n$ is calculated to be:

$$PFD_n = -120.4 \text{ dB(W/(m}^2 \cdot 1 \text{ MHz))}$$

[1] The single entry pfd is derived from an aggregate $I/N$ = –12.2 dB (corresponding to a 6% increase of the equivalent system noise temperature), assuming an equivalent number of 3.3 interfering sources, each transmitting at maximum single entry pfd.