

RECOMMENDATION ITU-R F.1819

Protection of the radio astronomy service in the 48.94-49.04 GHz band from unwanted emissions from HAPS in the 47.2-47.5 GHz and 47.9-48.2 GHz bands*

(2007)

Scope

This Recommendation provides a minimum separation distance between a radio astronomy station and the nadir of a HAPS platform in order to protect radio astronomy stations operating in the band 48.94-49.04 GHz from unwanted emissions of high altitude platform stations (HAPS) operating in the 47.2-47.5 GHz and 47.9-48.2 GHz bands.

Abbreviations

HAPS High altitude platform stations RAS radio astronomy service

UAC Urban area coverage

SAC Suburban area coverage

RAC Rural area coverage

The ITU Radiocommunication Assembly,

considering

- a) that new technology utilizing high altitude platform stations (HAPS) in the stratosphere is being developed;
- b) that WRC-97 made provisions for the operation of HAPS within the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- c) that Recommendation ITU-R F.1500 contains the characteristics of systems in the fixed service using HAPS operating in the 47.2-47.5 GHz and 47.9-48.2 GHz bands;
- d) that it is necessary to protect the radio astronomy service (RAS) operating in the 48.94-49.04 GHz band;
- e) that Resolution 122 (Rev.WRC-03) requested frequency sharing studies between the radio astronomy service and HAPS systems using the above-mentioned bands,

recommends

1 that, to protect radio astronomy stations operating in the band 48.94-49.04 GHz from unwanted emissions of HAPS operating in the 47.2-47.5 GHz and 47.9-48.2 GHz bands, the separation distance between the radio astronomy station and the nadir of a HAPS platform should exceed 50 km (see Annex 1).

* This Recommendation should be brought to the attention of Radiocommunication Study Group 7.

Annex 1

Methodology to determine the minimum separation between a RAS antenna and the nadir of a HAPS platform

1 Introduction

This Recommendation presents the results of compatibility studies between high altitude platform stations (HAPS) providing fixed wireless access (FWA) services in the 47.2-47.5 GHz and 47.9-48.2 GHz bands and the radio astronomy service (RAS) in the 48.94-49.04 GHz band (RR 5.555B) which is only used for spectral line RA observations. Based on the results of the study a minimum separation distance is proposed to protect RAS.

2 System characteristics

2.1 The HAPS system

The parameters used in this analysis are given in Recommendation ITU-R F.1500.

2.2 Threshold levels of interference detrimental to the radio astronomy service

The proposed threshold spectral power flux-density (spfd) level to protect an RAS station with a 0 dBi side-lobe antenna gain is $-209 \text{ dB(W/(m}^2 \cdot \text{Hz))}$ or $-149 \text{ dB(W/(m}^2 \cdot \text{MHz))}$. It is necessary to consider the actual RAS antenna gain G in order to determine whether the interference exceeds the detrimental threshold level.

RAS antennas typically have extremely high antenna gain, of the order of 70-80 dBi. In the model antenna response in Recommendation ITU-R SA.509, the side-lobe level at an angle of 5° from the main beam is 15 dBi. The 0 dBi side-lobe level occurs at an angle of 19.05° from the main beam axis. Because of the narrowness of the main beam, interference to a radio astronomy antenna is almost always received through the antenna side-lobes, so it is assumed here that the HAPS platform will not come closer than 5° to the RAS antenna main beam, so that the main beam response to interference is not considered in this study. Clearly it would be desirable to position the HAPS platform no closer than 20° from the antenna main beam, but that is not always practical. Hence in this study the interference criterion is taken to be $-164 \text{ dB(W/(m}^2 \cdot \text{Hz))}$ to allow for the side-lobe gain of the RAS antenna of 15 dBi.

2.3 Interference mitigation techniques

Each HAPS platform antenna contains a 12-section Chebyshev waveguide passband filter with a stop-band rejection ratio of better than 70 dB for unwanted emissions in frequencies greater than four 3 dB bandwidths from the passband. To further mitigate potential interference to the RAS at 49 GHz, it also has an integrated 5-section Chebyshev stop-band (notch) filter with a -25 dB notch depth within the 100 MHz stop-band. This provides a total stop-band rejection of more than 95 dB for the protection of the 49 GHz RAS band.

2.4 Interference scenario

The interference scenario assumed is shown in Fig. 1. In this scenario, the ground radio astronomy station that receives the interference signal emitted by a HAPS platform is located either at or beyond the edge of the HAPS coverage. The aggregate interference signal from all the transmitters on board the HAPS platform is computed to provide an upper limit to the power flux-density (pfd).