

RECOMMENDATION ITU-R F.1820

Power flux-density at international borders for high altitude platform stations providing fixed wireless access services to protect the fixed service in neighbouring countries in the 47.2-47.5 GHz and 47.9-48.2 GHz bands

(Question ITU-R 212/9)

(2007)

Scope

This Recommendation provides power flux density (pfd) values for the purpose of protecting conventional fixed service stations in neighbouring administrations from co-channel interference from a high altitude platform station (HAPS) operating in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz.

Acronyms

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 designated the 47.2-47.5 GHz and 47.9-48.2 GHz bands for use as a co-primary fixed service for HAPS deployment;
- c) that Recommendation ITU-R F.1500 contains the characteristics of systems in the fixed service planned for HAPS usage in the 47.2-47.5 GHz and 48.2-48.5 GHz bands;
- d) that, while the decision to deploy HAPS can be taken on a national basis, such deployment may affect neighbouring administrations, particularly in small countries,

recommends

1 that for the purpose of protecting conventional fixed service stations in neighbouring administrations from co-channel interference, based on the methodology described in Annex 1, a HAPS operating in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz should not exceed the following power flux-density (pfd) values at the Earth's surface outside an administration's borders, unless explicit agreement of the affected administration is provided at the time of the notification of HAPS:

-141	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for $0^\circ \leq \theta \leq 3^\circ$
$-141 + 2.0(\theta - 3)$	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for $3^\circ < \theta \leq 13^\circ$
-121	$\text{dB(W/(m}^2 \cdot \text{MHz))}$	for $13^\circ < \theta \leq 90^\circ$

where θ is the angle of the arrival above the horizontal plane of the Earth.

Annex 1

Methodology to determine pfd values at international borders for HAPS providing fixed wireless access services to protect the fixed service in neighbouring countries in the 47.2-47.5 GHz and 47.9-48.2 GHz bands

1 Introduction

This Annex describes a methodology for establishing pfd values at international borders for HAPS providing FWA services to protect conventional fixed service stations in neighbouring countries in the 47.2-47.5 GHz and 47.9-48.2 GHz bands, and the pfd limits at international borders for HAPS, based on the characteristics for HAPS in Recommendation ITU-R F.1500.

2 System characteristics

2.1 The high altitude platform system

The parameters used in this analysis are given in Recommendation ITU-R F.1500 and are as follows:

TABLE 1
HAPS coverage zones

Coverage area	Elevation angles (degrees)	Ground range (platform at 21 km) (km)
UAC	90-30	0-36
SAC	30-15	36-76.5
RAC	15-5	76.5-203

TABLE 2
Platform station transmitter parameters

Communication to	Transmitter power (dBW)	Antenna gain (dBi) ⁽¹⁾
UAC	1.3	30
SAC	1.3	30
RAC	3.5	38
Gateway (UAC)	0	35
Gateway (SAC)	9.7	38

⁽¹⁾ Maximum antenna gains.

2.2 Antenna radiation patterns

The antenna radiation patterns for platform antennas conform to Recommendation ITU-R S.672.

2.3 Atmospheric attenuation

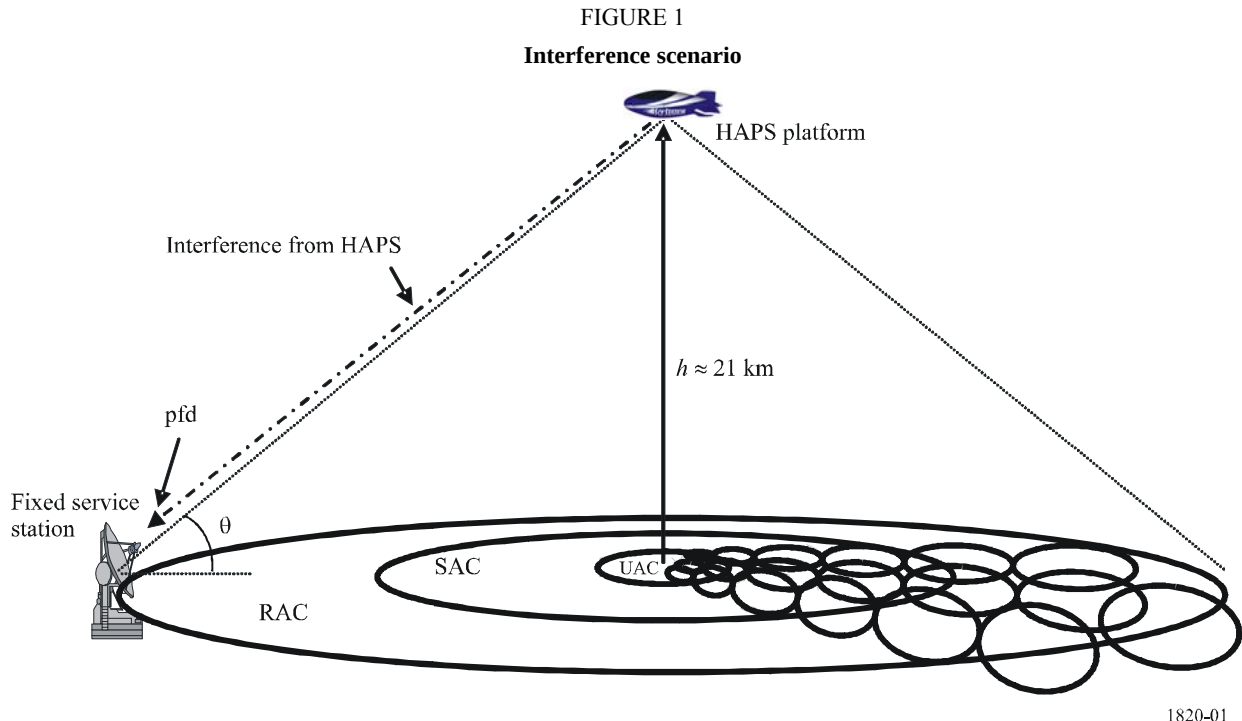
The atmospheric attenuation formulas are obtained from Recommendation ITU-R F.1501. For the interference analysis, only the minimum attenuation formula is of interest, hence the formula for the high-latitude regions at 47.2 GHz is selected to provide a worst-case analysis.

$$A_H(h, \theta) = 46.70/[1 + 0.6872\theta + 0.03637\theta^2 - 0.001105\theta^3 + 0.8087 \times 10^{-5}\theta^4] + h(0.2472 + 0.1819\theta) + h^2(0.04858 + 0.03221\theta) \quad (1)$$

The formula is valid for $0 \leq h \leq 3$ km and $0 \leq \theta \leq 90^\circ$, where θ (degrees) is the elevation angle of the ground station with respect to the HAPS platform, and h (km) is the altitude of the ground station above sea level. For actual elevation angles below 0° , the attenuation for 0° should be used.

2.4 Interference scenario

The interference scenario is assumed as shown in Fig. 1. In this scenario, the fixed service station of an adjacent administration that receives the interference signal emitted by HAPS is located either at or beyond the edge of the HAPS coverage. The aggregated interference signal from HAPS from all the transmitters on board the HAPS is computed to provide a pfd bound.



UAC, SAC and RAC describe respectively the urban, suburban and rural area coverage by HAPS.

The expected received pfd at the ground station receiver can be calculated by equation (2) as used in Recommendation ITU-R SF.1481-1:

$$fdr = P + Gt - Lt - La - Lp - 10 \log B - 10 \log (4\pi d^2) - 60 \text{ dB(W/(m}^2 \cdot \text{MHz))} \quad (2)$$