

RECOMMENDATION ITU-R F.1612

Interference evaluation of the fixed service using high altitude platform stations to protect the radio astronomy service from uplink transmission in high altitude platform station systems in the 31.3-31.8 GHz band

(Question ITU-R 230/9)

(2003)

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 operation of HAPS within the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- c) that since the 47 GHz bands are more susceptible to rain attenuation in those countries listed in Nos. 5.537A and 5.543A of the Radio Regulations (RR), the frequency range 18-32 GHz has been studied for possible identification of additional spectrum in ITU-R;
- d) that WRC-2000 made a provision for the use of HAPS in the fixed service in the bands 27.5-28.35 GHz and 31.0-31.3 GHz in certain countries on a non-harmful, non-protection basis in order to address issues of rain attenuation associated with the 47 GHz bands (RR Nos. 5.537A and 5.543A). Until WRC-03, since the 31.3-31.8 GHz band is allocated to the radio astronomy service (RAS), Earth exploration-satellite service (EESS) (passive) and space research service (passive), use of the band 31.0-31.3 GHz is limited to the lower half of the band (31.0-31.15 GHz);
- e) that Resolution 122 (Rev.WRC-2000) requests urgent studies on technical, sharing and regulatory issues in order to determine criteria for the operation of HAPS in the bands referred to in *considering* d) above;
- f) that it is necessary to protect appropriately the RAS, EESS (passive) and space research service (passive), taking into account RR No. 5.340 and the interference criteria given in Recommendations ITU-R SA.1029 and ITU-R RA.769,

recommends

- 1** that the methodology in Annexes 1, 2 and 3 should be used for the evaluation of interference by HAPS uplinks to the RAS in the frequency band 31.3-31.8 GHz;
- 2** that the location of HAPS airships and HAPS ground stations relative to the RAS station should be chosen to protect the RAS from unwanted emissions in the HAPS uplink in the 31.3-31.8 GHz band;

3 that in order to protect the RAS station from unwanted emissions via the HAPS uplink in the 31.3-31.8 GHz band, one or more spot beam cells around an RAS station should be excluded from the service area of the fixed service using HAPS.

NOTE 1 – Recommendation ITU-R F.1569 contains typical parameters describing the HAPS system for the evaluation of the impact of unwanted emissions on the RAS in the 31 GHz band.

NOTE 2 – The aggregate interference from fixed service, including HAPS, needs to be considered.

Annex 1

Typical parameters of the RAS and a model to be used for impact evaluation from HAPS ground station on the RAS station

1 Parameters of uplink transmission in HAPS system

The parameters regarding HAPS systems are based on Recommendation ITU-R F.1569 (altitude: 20-25 km, minimum operational elevation angle: 20°, and in rainy conditions). The footprint formed by a spot beam is referred to as a cell. A frequency reuse factor of four is adopted in this study, that is, the available frequency band of 300 MHz (31.0-31.3 GHz) is equally divided into four sub-bands of 75 MHz which are used simultaneously for uplink transmissions in multiple cells. An automatic power control scheme is adopted in the uplink, in which the power is increased or decreased by 6 dB, depending on weather conditions.

The level of out-of-band emissions in a HAPS uplink used in this study is –100 dB(W/MHz) under rainy conditions, assuming that automatic transmitting power control is being used in the uplink. The derivation of the out-of-band emission level is described in § 11 of Recommendation ITU-R F.1569.

2 Parameters of RAS

The parameters of RAS antennas used in this study are shown in Table 1. It is assumed that the RAS antenna is pointing at the azimuth of the HAPS ground station, at the minimum operational elevation for that particular radio telescope. The gain of the receiving antenna for the interference is calculated using Recommendation ITU-R SA.509 for the separation angle of more than 1° between the boresight direction of RAS antenna and the direction of arrival of the interference.

TABLE 1

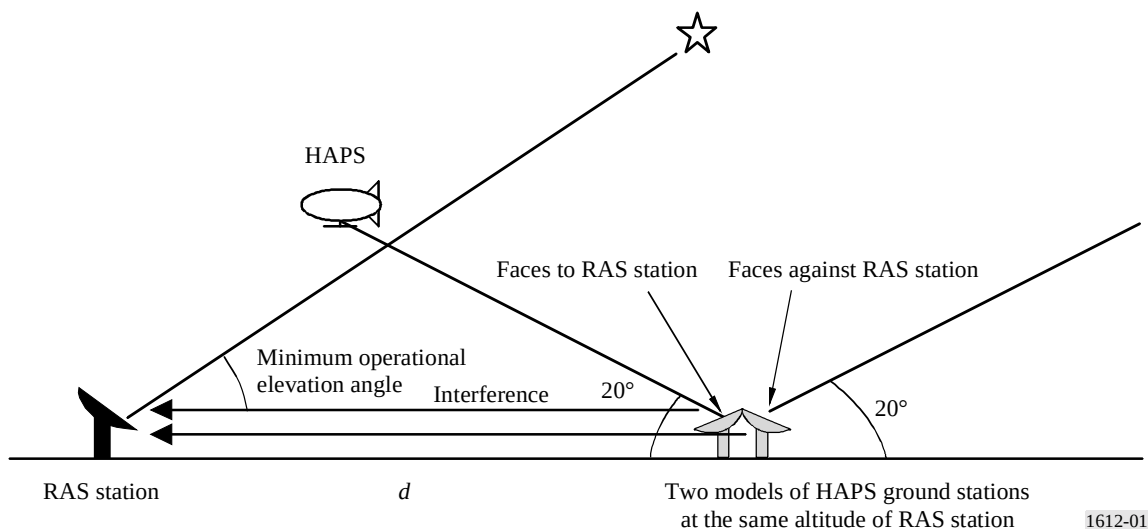
Parameters of RAS antennas used in this study

	G_{max} (dBi)	Diameter (m)	Altitude (km)	Minimum operational elevation angle (degrees)
Nobeyama (Japan)	81.2	45	1.35	15
Taeduk (Korea)	70.9	13.7	0.12	15
Delingha (China)	70.9	13.7	3.2	5

3 Interference evaluation model**3.1 Single entry**

Figure 1 shows the interference evaluation model for one HAPS ground station and one RAS station. It is assumed that HAPS ground station is located in the same plane as the RAS station. Two situations are considered regarding the antenna boresight direction of HAPS ground station. One is that the antenna of HAPS ground station faces to the RAS station in azimuth (worst case in the single entry scenario) and the other is that the antenna of HAPS ground station is directed at an azimuth 180° away from the direction of the RAS station. It is assumed that the RAS antenna is being operated with the minimum operational elevation angle in both cases.

FIGURE 1

Interference from a HAPS ground station to a RAS station (single entry case)

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