

RESOLUTION 122 (REV.WRC-19)

Use of the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz by high-altitude platform stations in the fixed service

The World Radiocommunication Conference (Sharm el-Sheikh, 2019),

considering

- a)* that the frequency band 47.2-50.2 GHz is allocated to the fixed service, the mobile service and the fixed-satellite service (FSS) on a co-primary basis;
- b)* that WRC-97 made provision for the operation of high-altitude platform stations (HAPS), also known as stratospheric repeaters, within the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- c)* that establishing a stable technical and regulatory environment will promote the use of all co-primary services in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- d)* that Recommendation ITU-R F.1500 contains the characteristics of systems in the fixed service using HAPS in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- e)* that, while the decision to deploy HAPS can be taken on a national basis, such deployment may affect the territory of other administrations and operators of co-primary services;
- f)* that the ITU Radiocommunication Sector (ITU-R) has completed studies dealing with sharing between systems using HAPS in the fixed service and other types of systems in the fixed service in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz;
- g)* that ITU-R has conducted studies dealing with compatibility between systems using HAPS and existing services in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, leading to Report ITU-R F.2476;
- h)* that No. **5.552** urges administrations to take all practicable steps to reserve FSS use of the frequency band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service (BSS) operating in the frequency band 40.5-42.5 GHz, and that ITU-R studies indicate that HAPS in the fixed service may share with such feeder links;
- i)* that the technical characteristics of expected BSS feeder links and FSS gateway-type stations are similar;
- j)* that ITU-R has updated studies on sharing between HAPS ground stations in the fixed service and the FSS, noting the negligible contribution to interference from HAPS stations to FSS space receivers,

recognizing

- a) that Recommendation ITU-R SF.1843 provides information on the feasibility of HAPS systems in the fixed service sharing with the FSS;
- b) that ITU-R studies have established specific power flux-density (pfd) values to be met at international borders to facilitate sharing conditions for HAPS with other types of fixed-service systems in a neighbouring country;
- c) that FSS networks and systems with earth station antenna diameters of 2.5 metres or larger operating as a gateway-type station are capable of sharing with HAPS ground stations;
- d) that, during periods of rain, the equivalent isotropically radiated power (e.i.r.p.) of the beam of the HAPS system suffering rain fade may be increased by a level commensurate with the level of rain fade, by up to 20 dB above the e.i.r.p. under clear-sky conditions indicated in Appendix 4,

resolves

1 that to facilitate sharing with the FSS (Earth-to-space), the maximum transmit e.i.r.p. density of a HAPS ground station shall not exceed the following levels under clear-sky conditions:

6.4	dB(W/MHz)	for	30° < θ ≤ 90°
22.57	dB(W/MHz)	for	15° < θ ≤ 30°
28	dB(W/MHz)	for	5° < θ ≤ 15°

where θ is the HAPS ground station elevation angle in degrees (angle of arrival above the horizontal plane);

2 that the ground station antenna patterns of HAPS operating in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz shall meet the following antenna beam patterns:

$$G(\varphi) = G_{max} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda} \varphi \right)^2 \quad \text{for} \quad 0^\circ < \varphi < \varphi_m$$

$$G(\varphi) = 39 - 5 \log(D/\lambda) - 25 \log \varphi \quad \text{for} \quad \varphi_m \leq \varphi < 48^\circ$$

$$G(\varphi) = -3 - 5 \log(D/\lambda) \quad \text{for} \quad 48^\circ \leq \varphi \leq 180^\circ$$

where:

G_{max} : maximum antenna gain (dBi)

$G(\varphi)$: gain (dBi) relative to an isotropic antenna

φ : off-axis angle (degrees)

D : antenna diameter }
 λ : wavelength } expressed in the same units

$$\varphi_m = \frac{20 \lambda}{D} \sqrt{G_{max} - G_1} \text{ degrees}$$

G_1 : gain of the first side lobe

$$= 2 + 15 \log(D/\lambda) \text{ (dBi);}$$

3 that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, the pfd level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

-141	dB(W/(m ² · MHz))	for	0° ≤ θ < 3°
-141 + 2(θ - 3)	dB(W/(m ² · MHz))	for	3° ≤ θ ≤ 13°
-121	dB(W/(m ² · MHz))	for	13° < θ ≤ 90°

where θ is the angle of the arrival of the incident wave above the horizontal plane, in degrees;

4 that, for the purpose of protecting mobile-service systems in the territory of other administrations in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, the pfd level per HAPS produced at the surface of the Earth in the territory of other administrations shall not exceed the following limits, developed for clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

-106	dB(W/(m ² · MHz))	for	0° ≤ θ ≤ 4°
-106 + 1.2 (θ - 4)	dB(W/(m ² · MHz))	for	4° < θ ≤ 11.5°
-97	dB(W/(m ² · MHz))	for	11.5° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees.

The limits above take into account the 3 dB aggregate loss due to polarization mismatch, and body loss was not taken into account;

5 that, to protect radio astronomy stations operating in the frequency band 48.94-49.04 GHz from unwanted emissions of HAPS operating in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz, the separation distance between the radio astronomy station and the nadir of a HAPS platform shall exceed 50 km;

6 that administrations planning to implement a HAPS system in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to the Radiocommunication Bureau for the examination of compliance with respect to this Resolution with a view to their registration in the Master International Frequency Register,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

