

RESOLUTION 165 (WRC-19)

Use of the frequency band 21.4-22 GHz by high-altitude platform stations in the fixed service in Region 2

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

considering

- a)* that there is a need for greater broadband connectivity in underserved communities and in rural and remote areas;
- b)* that WRC-15 invited the ITU Radiocommunication Sector (ITU-R) to study additional spectrum needs for fixed high-altitude platform station (HAPS) links to provide broadband connectivity and to facilitate the use of HAPS links on a global or regional basis, recognizing that the existing HAPS identifications were established without reference to today's broadband capabilities;
- c)* that HAPS can provide broadband connectivity with minimal ground network infrastructure;
- d)* that ITU-R has conducted studies dealing with compatibility between systems using HAPS and existing services in the frequency band 21.4-22 GHz in Region 2, leading to Report ITU-R F.2471,

considering further

that current technologies can be used to deliver broadband applications by HAPS, which can provide broadband connectivity and disaster-recovery communications with minimal ground network infrastructure,

recognizing

- a)* that a HAPS is defined in No. **1.66A** as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth, and is subject to No. **4.23**;
- b)* that the aeronautical mobile service (AMS) within the mobile service operates in the frequency range 21.2-21.5 GHz on a primary basis within Region 2,

noting

- a)* that limits to be met at the border by HAPS transmitters may not be appropriate for frameworks for the introduction of HAPS nationally;
- b)* that Reports ITU-R F.2438 and ITU-R F.2439 provide information relevant to the development of a framework for the introduction of HAPS by administrations,

RES165-2

resolves

1 that, for the purpose of protecting fixed-service systems in the territory of other administrations in the frequency band 21.4-22 GHz, the power flux-density (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:

0.7 θ – 135	dB(W/(m ² · MHz))	for	0° ≤ θ < 10°
2.4 θ – 152	dB(W/(m ² · MHz))	for	10° ≤ θ < 20°
0.45 θ – 113	dB(W/(m ² · MHz))	for	20° ≤ θ < 60°
–86	dB(W/(m ² · MHz))	for	60° ≤ θ ≤ 90°

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

During periods of rain, the equivalent isotropically radiated power (e.i.r.p.) of the beam 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. associated with the above pfd mask at the surface of the Earth;

2 that, for the purpose of protecting the Earth exploration-satellite service (EESS) (passive) in the frequency bands 21.2-21.4 GHz and 22.21-22.5 GHz, the e.i.r.p. density in the frequency bands 21.2-21.4 GHz and 22.21-22.5 GHz per HAPS operating in the frequency band 21.4-22 GHz shall not exceed:

–0.76 θ – 9.5	dB(W/100 MHz)	for	–4.53° ≤ θ < 35.5°
–36.5	dB(W/100 MHz)	for	35.5° ≤ θ ≤ 90°

where θ is the elevation angle in degrees at the platform height;

3 that, in order to ensure the protection of the radio astronomy service (RAS), the pfd level produced by unwanted emissions from HAPS downlink transmissions in the frequency band 21.4-22 GHz shall not exceed –176 dB(W/(m² · 290 MHz)) for continuum observations and –192 dB(W/(m² · 250 kHz)) for spectral line observations in the frequency band 22.21-22.5 GHz at an RAS station location at a height of 50 m; this limit relates to the pfd which would be obtained using a time percentage of 2% in the relevant propagation model.

To verify compliance, the following formula shall be used:

$$pfd = e.i.r.p. \cdot p.nominal \text{ clear sky} (Az, \theta) + Att_{618, p=2\%} - 10 \log(4\pi d^2) - GasAtt(\theta)$$

where:

e.i.r.p.nominal clear sky: nominal unwanted emission e.i.r.p. density towards the RAS station at which the HAPS operates under clear-sky conditions in dB(W/290 MHz) for continuum observations and in dB(W/250 kHz) for spectral line observations in the frequency band 22.21-22.5 GHz

Az: azimuth in degrees from the HAPS towards the RAS station

θ : elevation angle in degrees at the HAPS towards the RAS station

$Att_{618p=2\%}$: attenuation in dB from Recommendation ITU-R P.618 corresponding to $p = 2\%$ of the time at the radio astronomy location

d : separation distance in metres between the HAPS and the RAS station

$GasAtt(\theta)$: gaseous attenuation for an elevation angle of θ (see Recommendation ITU-R SF.1395);

4 that *resolves* 3 applies at any radio astronomy station that was in operation prior to 22 November 2019 and has been notified to the Radiocommunication Bureau (BR) in the frequency band 22.21-22.5 GHz before 22 May 2020, or at any radio astronomy station that was notified before the date of receipt of the complete Appendix 4 information for notification, for the HAPS system to which *resolves* 3 applies; radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS;

5 that, for the purpose of protecting the AMS operating in the frequency band 21.2-21.5 GHz, the e.i.r.p. per HAPS shall not exceed 17.5 dB(W/100 MHz) in the frequency range 21.4-21.5 GHz;

6 that administrations planning to implement a HAPS system in the frequency band 21.4-22 GHz shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to BR 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.

