## RESOLUTION 165 (REV.WRC-23)

# 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 (Dubai, 2023),

### 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,

#### 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:

$0.7 \theta - 135$	$dB(W/(m^2 \cdot MHz))$	for	$0^\circ \le \theta < 10^\circ$
$2.4 \theta - 152$	$dB(W/(m^2\cdot MHz))$	for	$10^\circ \le \theta < 20^\circ$
$0.45\;\theta-113$	$dB(W/(m^2\cdot MHz))$	for	$20^\circ \le \theta < 60^\circ$
-86	$dB(W/(m^2 \cdot MHz))$	for	$60^\circ \le \theta \le 90^\circ$

where  $\theta$  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 (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:

$-0.76 \theta - 9.5$	dB(W/100 MHz)		$-4.53^{\circ} \le \theta < 35.5^{\circ}$
-36.5	dB(W/100 MHz)	for	$35.5^\circ \le \theta \le 90^\circ$

where  $\theta$  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  $-176 \text{ dB}(\text{W}/(\text{m}^2 \cdot 290 \text{ MHz}))$  for continuum observations and  $-192 \text{ dB}(\text{W}/(\text{m}^2 \cdot 250 \text{ kHz}))$  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:

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

where:

*e.i.r.p.*<sub>nominal clear sky</sub>: 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
- $\theta$ : elevation angle in degrees at the HAPS towards the RAS station
- Att<sub>618p=2%</sub>: attenuation in dB from the most recent version of 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  $\theta$  (see the most recent version of 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 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 the 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.