
PLENARY MEETING

**Addendum 4 to
Document 6180(Add.14)-
E
29 August 2019
Original: English**

Member States of the Inter-American Telecommunication Commission (CITEL)

PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda item 1.14

1.14 to consider, on the basis of ITU-R studies in accordance with Resolution **160 (WRC-15)**, appropriate regulatory actions for high-altitude platform stations (HAPS), within existing fixed-service allocations;

Part 4 – Frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz

BACKGROUND

No. 1.66A of the ITU Radio Regulations define a high-altitude platform station (HAPS) as "a station on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth".

Advances in aeronautics and transmission technologies have significantly improved the capabilities of HAPS to provide effective connectivity solutions and meet the growing demand for high capacity broadband networks, particularly in currently underserved areas. Recently conducted full-scale test flights have shown that solar-powered platforms in the upper-atmosphere can now be used to carry payloads that offer reliable and cost-effective connectivity, and a growing number of applications for the new generation of HAPS are being developed. The technology appears particularly well suited to provide backhaul for terrestrial networks and facilitate emergency response in case of natural disaster.

Agenda Item 1.14 was adopted by WRC-15 to consider, in accordance with Resolution 160 (WRC-15), regulatory actions to facilitate deployment of HAPS for broadband applications. Resolution 160 resolves to invite ITU-R to study additional spectrum needs of HAPS, considering changes of regulatory provisions in existing HAPS identifications and potential new identifications in the 38-39.5 GHz band on a global basis and in 21.4-22 GHz and 24.25-27.5 GHz bands in Region 2 exclusively.

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations (See No. 2.1)

MOD IAP/6180A14A4/1

40-47.5 GHz

Allocation to services		
Region 1	Region 2	Region 3
47.2-47.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE <u>MOD</u> 5.552A	

Reasons: HAPS identification on a global level and protect incumbent services with an associated new Resolution 122 (REV. WRC-19)

MOD IAP/6180A14A4/2

47.5-51.4 GHz

Allocation to services		
Region 1	Region 2	Region 3
47.9-48.2	FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE <u>MOD</u> 5.552A	

Reasons: HAPS identification on a global level and protect incumbent services with an associated new Resolution 122 (REV. WRC-19)

MOD IAP/6180A14A4/3

5.552A The allocation to the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz is designated-identified for use by high altitude platform stations (HAPS). This identification does not preclude the use of this frequency band by any application of the services to which it is allocated on a co-primary basis and does not establish priority in the Radio Regulations. The Such use of the fixed-service allocation in bands 47.2-47.5 GHz and 47.9-48.2 GHz by HAPS shall be in accordance with is-subject to the provisions of Resolution **122 (Rev.WRC-0719)**. (WRC-0719)

Reasons: This footnote aims to facilitate the use of HAPS identification on a global level and protect incumbent services with an associated new Resolution 122 (REV. WRC-19).

MOD IAP/6180A14A4/4

RESOLUTION 122 (REV.WRC-1907)

Use of the bands 47.2-47.5 GHz and 47.9-48.2 GHz by high altitude platform stations (HAPS) in the fixed service and by other services

The World Radiocommunication Conference (Geneva Sharm el-Sheikh, 201907),

considering

a) that the band 47.2-50.2 GHz is allocated to the fixed, mobile and fixed-satellite services on a co-primary basis;

b) that WRC-97 made provision for operation of high altitude platform stations (HAPS), also known as stratospheric repeaters, within the fixed service in the 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 band 47.2-47.5 GHz and 47.9-48.2 GHz;

~~*d)* that systems using HAPS are in an advanced stage of development and some countries have notified such systems to ITU in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;~~

ed) that Recommendation ITU-R F.1500 contains the characteristics of systems in the fixed service using HAPS in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

fe) that while the decision to deploy HAPS can be taken on a national basis, such deployment may affect the territory of otherneighbouring administrations and operators of co-primary services;

gf) that 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 bands 47.2-47.5 GHz and 47.9-48.2 GHz;

~~*h)* that ITU-R has completed studies on compatibility between HAPS systems in the 47.2-47.5 GHz and 47.9-48.2 GHz bands and the radio astronomy service in the 48.94-49.04 GHz band;~~

~~*hg)* that No. 5.552 urges administrations to take all practicable steps to reserve fixed-satellite service (FSS) use of the band 47.2-49.2 GHz for feeder links for the broadcasting-satellite service (BSS) operating in the band 40.5-42.5 GHz, and that ITU-R studies indicate that HAPS in the fixed service may share with such feeder links;~~

ih) that the technical characteristics of expected BSS feeder links and FSS gateway-type stations are similar;

kj) that ITU-R has completed studies dealing with sharing between systems using HAPS in the fixed service and the fixed-satellite service,

recognizing

~~a) _____ that, in the long term, the bands 47.2-47.5 GHz and 47.9-48.2 GHz are expected to be required for HAPS operations for both gateway and ubiquitous terminal applications, for which several administrations have already notified systems to the Radiocommunication Bureau;~~

~~b) _____ that identification of common sub bands for ubiquitous ground terminal applications in the use of the fixed service could facilitate HAPS deployment and sharing with other primary services in the 47.2-47.5 GHz and 47.9-48.2 GHz bands;~~

~~eb) that Recommendation ITU-R SF.1481-1 and Recommendation ITU-R SF.1843 provides information on the feasibility of HAPS systems in the fixed service sharing with the FSS;~~

~~d) _____ that ITU-R studies on HAPS operation in the bands 47.2-47.5 GHz and 47.9-48.2 GHz allocated to the fixed service have concluded that, in order to share with FSS (Earth to space), the maximum uplink transmit e.i.r.p. density of HAPS ground terminals in the bands should, in clear sky conditions, be 6.4 dB(W/MHz) for Urban Area Coverage (UAC), 22.57 dB(W/MHz) for Suburban Area Coverage (SAC) and 28 dB(W/MHz) for Rural Area Coverage (RAC), and that these values can be increased by up to 5 dB during periods of rain;~~

~~dc) that ITU-R studies have established specific power flux-density values to be met at international borders to facilitate sharing conditions for HAPS with other types of fixed service systems within a concerned country;~~

~~e) _____ that ITU-R studies have established specific power flux-density values to be met at international borders to facilitate bilateral agreement on sharing conditions for HAPS with other types of fixed service systems in a neighbouring country;~~

~~fd) that FSS satellite 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 ubiquitous HAPS ground stations terminals,~~

resolves

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

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

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

~~2 _____ that these maximum transmit e.i.r.p. density levels specified in resolves 1 may be increased during periods of rain, using fading compensation techniques, by up to 5 dB during periods of rain up to levels commensurate with the rain fade;~~

32 that the ground station terminal antenna patterns of HAPS operating in the 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

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

G_1 : gain of the first side lobe

$2 + 15 \log (D/\lambda)$ (dBi);

43 that for the purpose of protecting fixed wireless systems in the territory of other administrations from co-channel interference, the power flux density level per HAPS system produced at the surface of the Earth in territory of other administrations shall not exceed the following limits unless explicit agreement of the affected administrations is provided at the time of the notification of HAPS:

$$-141 \text{ dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ \leq \theta \leq 3^\circ$$

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

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

where θ is the angle of the arrival above the horizontal plane in degrees. These limits relate to the power flux density which would be obtained under clear-sky conditions.

4 that for the purpose of protecting systems in the mobile service in neighbouring administrations, a HAPS system operating in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz shall not exceed the following power flux density values at the Earth's surface applied at the border of neighboring territory without the explicit agreement of the affected administrations:

$$\underline{-106 \text{ dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 0^\circ \leq \theta \leq 4^\circ}$$

$$\underline{-106 + 1.2 (\theta - 4) \text{ dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 4^\circ < \theta \leq 11.5^\circ}$$

$$\underline{-97 \text{ dB(W/(m}^2 \cdot \text{MHz))} \quad \text{for} \quad 11.5^\circ < \theta \leq 90^\circ}$$

where θ is the elevation angle in degrees (angle of arrival above the horizontal plane for HAPS station and below the horizon for the HAPS ground station).

These limits take into account 3 dB aggregate loss due to polarization mismatch. However, the limits above do not take into account body and gaseous losses.

5 that, to protect radio astronomy stations operating in the band 48.94-49.04 GHz from unwanted emissions of HAPS system operating in the 47.2-47.5 GHz and 47.9-48.2 GHz bands, the maximum separation distance between the radio astronomy station and the nadir of a HAPS platform required for coordination purposes shall exceed 50 is 200 km;

6 that administrations planning to implement a HAPS system in the 47.2-47.5 GHz and 47.9-48.2 GHz bands shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to the Bureau for the examination of compliance with respect to *resolves* 1, 2, 3, 4, 5 and 5-6 above with a view to their registration in the Master International Frequency Register;

7 that administrations shall notify the new data elements for the notices referred to in *instructs the Director of the Radiocommunication Bureau* 1 in order to enable the Bureau to perform the examinations,

invites administrations

that intend to deploy HAPS systems in the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz to consider specifying the use of the bands 47.2-47.35 GHz and 47.9-48.05 GHz for ubiquitous HAPS terminalssystems,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

~~1 ——— to maintain and process notices concerning HAPS that were received by the Bureau prior to 20 October 2007 and provisionally recorded in the Master International Frequency Register, only until 1 January 2012, unless the notifying administration informs the Bureau before that date that a particular assignment has been brought into use and provides the complete set of data elements of Appendix 4;~~

~~2 ——— to examine all assignments to HAPS in the fixed service notified prior to 20 October 2007 and apply the provisions of *resolves* 1, 2, 3, 4 and 5 and the respective calculation methodologies included in Recommendation ITU-R F.1820 and Recommendation ITU-R SF.1843.~~

Reasons: Amend the existing Resolution 122 (WRC-19) to take into account last technological improvement of HAPS technology.