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**PLENARY MEETING**

**Addendum 2 to  
Document 6172(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 2 – Frequency band 24.25-27.5 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/6172A14A2/1**

**22-24.75 GHz**

Allocation to services		
Region 1	Region 2	Region 3
<b>24.25-24.45</b> FIXED	<b>24.25-24.45</b> <u>FIXED ADD 5.C114</u> RADIONAVIGATION	<b>24.25-24.45</b> RADIONAVIGATION FIXED MOBILE
<b>24.45-24.65</b> FIXED INTER-SATELLITE	<b>24.45-24.65</b> <u>FIXED ADD 5.C114</u> INTER-SATELLITE RADIONAVIGATION  5.533	<b>24.45-24.65</b> FIXED INTER-SATELLITE MOBILE RADIONAVIGATION 5.533
<b>24.65-24.75</b> FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE	<b>24.65-24.75</b> <u>FIXED ADD 5.C114</u> INTER-SATELLITE RADIOLOCATION- SATELLITE (Earth-to-space)	<b>24.65-24.75</b> FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE 5.533

**Reasons:** To add a primary fixed service allocation to the 24.25-25.25 GHz band and a new identification for HAPS in the band 24.25-25.25 GHz in Region 2.

**MOD IAP/6172A14A2/2**

**24.75-29.9 GHz**

Allocation to services		
Region 1	Region 2	Region 3
<b>24.75-25.25</b> FIXED FIXED-SATELLITE (Earth-to-space) 5.532B	<b>24.75-25.25</b> <u>FIXED ADD 5.C114</u> FIXED-SATELLITE (Earth-to-space) 5.535	<b>24.75-25.25</b> FIXED FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE

**Reasons:** To add a primary fixed service allocation to the 24.25-25.25 GHz band and a new identification for HAPS in the band 24.25-25.25 GHz in Region 2.

**ADD IAP/6172A14A2/3**

**5.C114** The allocation to the fixed service in the band 24.25-25.25 GHz is identified for and limited to use in Region 2 by high-altitude platform stations (HAPS), without any priority with respect to the other co-primary services allocated in this band. Such use of the fixed-service allocation by HAPS is limited to the HAPS-to-ground direction and shall be in accordance with the provisions of Resolution **[IAP/C114] (WRC-19)**. (WRC-19)

**Reasons:** To add the text of the footnote allowing HAPS to operate in the fixed service allocation in the 24.25-25.25 GHz band. The limitation of the use of HAPS in the HAPS-to-ground direction in the 24.25-25.25 GHz band is to ensure the protection of the:

- FSS (E-s) operating in the 24.75-25.25 GHz band;
- ISS operating in the 24.45-24.75 GHz band;
- EESS (passive) operating in the 23.6-24 GHz band.

**MOD IAP/6172A14A2/4**

**24.75-29.9 GHz**

Allocation to services		
Region 1	Region 2	Region 3
25.25-25.5	FIXED <a href="#">ADD 5.D114</a> INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to-space)	
25.5-27	EARTH EXPLORATION-SATELLITE (space-to Earth) 5.536B FIXED <a href="#">ADD 5.D114</a> INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space) 5.536A	
27-27.5 FIXED INTER-SATELLITE 5.536 MOBILE	27-27.5 FIXED <a href="#">ADD 5.D114</a> FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE	
5.540 5.542	5.525 5.526 5.527 5.529 5.540	5.540 5.542

**Reasons:** To add a footnote to the 25.25-27.5 GHz band in Region 2 allowing HAPS to operate in the fixed service allocation.

**ADD IAP/6172A14A2/5**

**5.D114** The allocation to the fixed service in the band 25.25-27.5 GHz is identified for use in Region 2 by high-altitude platform stations (HAPS) in accordance with the provisions of Resolution **[IAP/C114]**. Such use of the fixed-service allocation by HAPS shall be limited to the ground-to-HAPS direction in the frequency band 25.25-27.0 GHz and to the HAPS-to-ground direction in the frequency band 27.0-27.5 GHz. Furthermore, the use of the band 25.5-27.0 GHz by HAPS shall be limited to gateway links. 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. (WRC 19)

**Reasons:** To add the text of the footnote allowing HAPS to operate in the fixed service allocation in the 25.25-27.5 GHz band. The limitation of the use of HAPS in the ground-to-HAPS direction in the 25.5-27 GHz band to gateway links is to ensure the protection of EESS/SRS allocations in the 25.5-27 GHz band. The limitation of the use of HAPS in the HAPS-to-ground direction in the 27-27.5 GHz band is to ensure the protection of the FSS (E-s) and ISS operating in the same band.

**ADD IAP/6172A14A2/6**

DRAFT NEW RESOLUTION [IAP/C114] (WRC-19)

**Use of the bands 24.25-27.5<sup>1</sup> GHz by fixed links for high-altitude platform stations in the fixed service in Region 2**

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

*considering*

- a) that WRC-15 considered that there is a need for greater broadband connectivity in underserved communities and in rural and remote areas, that current technologies can be used to deliver broadband applications by high-altitude platform stations (HAPS), which can provide broadband connectivity and disaster recovery communications with minimal ground network infrastructure;
- b) that WRC-15 decided to study additional spectrum needs for fixed HAPS links to provide broadband connectivity, including within the band 24.25-27.5 GHz in Region 2, 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 HAPS systems and systems in existing services in the 24.25-27.5 GHz band and in adjacent band in Region 2 leading to Report ITU-R F.[HAPS-25GHz],

*recognizing*

- a) that in the bands 24.75-25.25 GHz and 27.0-27.5 GHz with respect to earth stations in the fixed-satellite service (Earth-to-space) and HAPS ground station receivers which operate in the fixed service, No. **9.17** applies;
- b) that HAPS is defined in No. **1.66A** of the Radio Regulations as a station located on an object at an altitude of 20-50 km and at a specified, nominal, fixed point relative to the Earth, and is subject to No. **4.23**,

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<sup>1</sup> Note: One CITEL administrations has supported a varied spectrum identification of bands for HAPS, however supports the regulatory provisions presented in this Resolution.

*resolves*

1 that for the purpose of protecting the fixed service systems in territory of other administrations in the band 27-27.5 GHz, the power flux density limit per HAPS at the surface of the Earth in territory of other administrations shall not exceed the following limits unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

$$\begin{array}{llll} 0.39 \theta - 132.12 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for} & 0^\circ \leq \theta < 13^\circ \\ 2.715 \theta - 162.3 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for} & 13^\circ \leq \theta < 20^\circ \\ 0.45 \theta - 117 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for} & 20^\circ \leq \theta < 60^\circ \\ -90 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for} & 60^\circ \leq \theta \leq 90^\circ \end{array}$$

where  $\theta$  is the angles of arrival of the incident wave above the horizontal plane;

These limits relate to the power flux density which would be obtained under clear-sky conditions with assumed free-space propagation. These limits were derived by taking into account the impact of gaseous attenuation and polarization loss;

2 that for the purpose of protecting the mobile service systems in territory of other administrations in the band 24.25-25.25 GHz and 27-27.5 GHz, the power flux density level per HAPS at the surface of the Earth in territory of other administrations shall not exceed the following limits unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

$$\begin{array}{llll} 0.95 \theta - 114 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for} & 0^\circ \leq \theta < 5.7^\circ \\ 0.6 \theta - 112 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for} & 5.7^\circ \leq \theta < 20^\circ \\ -100 & \text{dB(W/(m}^2 \cdot \text{MHz))} & \text{for} & 20^\circ \leq \theta \leq 90^\circ \end{array}$$

where  $\theta$  is the elevation angle in degrees (angle of arrival above the horizontal plane).

These limits relate to the power flux density which would be obtained under clear-sky conditions with assumed free-space propagation. These limits were derived by taking into account the impacts of polarization, gaseous attenuation and body loss for user equipment;

2bis “that for the purpose of protecting mobile service systems operating in the frequency band 25.25 - 27 GHz in neighboring administrations, coordination of a transmitting HAPS ground station is required when the power-flux density in dB(W/m<sup>2</sup>/MHz) at the border of a neighboring administration exceeds a pfd limit of -110.3 dB(W/m<sup>2</sup>/MHz). This limit does take into account 3 dB aggregate loss due to polarization mismatch. However, the limit does not take into account body loss;

3 that for the purpose of protecting the Inter-Satellite service, the e.i.r.p. density per HAPS in the band 27-27.5 GHz, shall not exceed -70.7 dB(W/Hz) for off-nadir angle higher than 85.5°;

4 that for the purpose of protecting the inter-satellite service, the e.i.r.p. density per HAPS in the bands 24.45-24.75 GHz, shall not exceed  $-19.9$  dB(W/MHz) for off-nadir angle higher than  $85.5^\circ$ ;

5 that for the purpose of protection the Inter-Satellite service, the e.i.r.p. density per HAPS ground station in the band 25.25-27 GHz, shall not exceed  $12.3$  dB(W/MHz) under clear sky conditions.

During periods of rain, the e.i.r.p. density limits for clear-sky conditions can be exceeded to the level needed to compensate for rain fade, up to  $20$  dB;

6 that for the purpose of protecting the Fixed Satellite service, the e.i.r.p. density per HAPS, in the bands 24.75-25.25 and 27-27.5 GHz, shall not exceed  $-9.1$  dB(W/MHz) for off-nadir angle higher than  $85.5^\circ$ ;

7 that for the purpose of protecting the Earth Exploration Satellite passive services , the e.i.r.p. density in the band 23.6-24 GHz per HAPS operating in the band 24.25-25.25 GHz, shall not exceed:

$$\begin{array}{lll} -0.7714 \theta - 16.5 & \text{dB(W/200 MHz)} & \text{for } -4.53^\circ \leq \theta < 35^\circ \\ -43.5 & \text{dB(W/200 MHz)} & \text{for } 35^\circ \leq \theta \leq 90^\circ \end{array}$$

where  $\theta$  is the elevation angle in degrees (angles of arrival above the horizontal plane);

8 that in order to ensure the protection of in-band SRS/EESS satellite services from the HAPS gateway in the band 25.5-27.0 GHz, the power flux density shall not exceed the threshold values below at the SRS/EESS earth stations. If the power flux density threshold values below are exceeded, then HAPS shall coordinate in accordance with No. **9.18**, taking into account the parameters of the relevant systems. These limits relate to the power flux density which would be obtained under assumed propagation conditions predicted by Recommendation ITU-R P.452 using the following time percentages:  $0.001\%$  for SRS,  $0.005\%$  for EESS NGSO, and  $20\%$  for EESS GSO:

**SRS**

$$pfd, dB \left( \frac{W}{m^2 * MHz} \right) = -121.33$$

**EESS NGSO**

$$pfd, dB \left( \frac{W}{m^2 * MHz} \right) = -96.87$$

**EESS GSO**

$$pfd, dB \left( \frac{W}{m^2 * MHz} \right) = -128.57$$

9 that in order to ensure the protection of the radio astronomy service, the power flux density produced by unwanted emissions from HAPS downlink transmissions operating in the band 24.25-25.25 GHz shall not exceed -177 dB (W/(m<sup>2</sup>.400 MHz)) for continuum observations and -191 dB (W/(m<sup>2</sup>.250 kHz)) for spectral line observations in the band 23.6-24 GHz at an RAS station location at the height of 50 m. These limits relate to power flux density which would be obtained using a time percentage of 2% in the relevant propagation model;

10 that *resolves 10* shall apply at any radio astronomy station that was in operation prior to 22 November 2019 and has been notified to the Bureau in the band 23.6-24 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 10* apply. Radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS;

11 that administrations planning to implement a HAPS system in the 24.25-27.5GHz band shall notify the frequency assignments by submitting all mandatory elements of Appendix 4 to the Bureau for the examination of compliance with respect to the Radio Regulations 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.

**Reasons:** To add the text of a resolution specifying the operating requirements for HAPS to protect other services for the directions indicated in the Article 5 footnotes.