**UNITED STATES OF AMERICA**

**DRAFT PROPOSAL FOR THE WORK OF THE CONFERENCE**

**Agenda Item 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.*

# 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". Agenda Item 1.14 was adopted by WRC-15 to consider, in accordance with Resolution 160 (WRC-15), regulatory actions that can facilitate deployment of HAPS for broadband applications. Resolution 160 resolves to invite ITU-R to study additional spectrum needs of HAPS, examining the suitability of existing HAPS designations and conducting sharing and compatibility studies for additional designations in existing fixed allocations in the 38-39.5 GHz band on a global basis and in 21.4-22 GHz and 24.25-27.5 GHz bands only in Region 2. Resolution 160 also states that existing services and their applications shall be protected from HAPS applications, and no undue constraints shall be imposed on the future development of existing services by HAPS.

The ITU-R developed a Preliminary New Draft Recommendation (PDNR) assessing spectrum needs for broadband HAPS which concludes “These assumed system characteristics show that the spectrum needs for HAPS are in the range from 396 MHz to 2 969 MHz for the uplink and 324 MHz to 1 505 MHz for downlink, for both GW and CPE links, which would need to be considered within existing and/or new HAPS designations. These ranges include the spectrum needs to cover those of specific applications (e.g., disaster relief missions) plus that for connectivity applications (e.g., commercial broadband).”

Currently there are 3 spectrum bands identified for HAPS in the fixed services. These are:

- 47.2–47.5 GHz and 47.9 48.2 GHz,

- 27.9-28.2 GHz (HAPS-ground) and 31.0-31.3 GHz (ground-HAPS),

- 6 440–6 520 MHz (HAPS-ground) and 6 560-6 640 MHz (ground-HAPS).

The amount of spectrum in the 3 spectrum bands identified for HAPS is 1360 MHz which exceeds the minimum spectrum needs of HAPS of 720 MHz by nearly 200%. However, the global designations for HAPS links (which is in the 47.2-47.5 GHz band fixed-service allocation paired with the 47.9-48.2 GHz band fixed-service allocation) suffers from the effects of rain fade attenuation that severely limit service provision over high-precipitation geographies. The remaining 2 available bands (27.9-28.2 GHz paired with the frequency band 31.0-31.3 GHz, and 6440-6 520 MHz paired with 6 560-6 640 MHz) have been identified by a limited number of countries, none of which is within ITU Region 2.

Spectrum harmonization and utilization is facilitated by common worldwide designations. International regulatory flexibility can enable improvements in global connectivity by encouraging national regulators to permit operation of higher-speed Internet access services over new, complementary platforms, while ensuring protection of existing services. Additionally, harmonization of spectrum promotes economies of scale and commonality of equipment.

**BROADBAND HAPS APPLICATIONS**

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 connectivity over large areas in a reliable and cost-effective way, and a growing number of applications for the new generation of HAPS are being developed. The technology appears particularly well suited to complementing terrestrial networks by providing backhaul. A number of advantages of the new generation of HAPS are foreseen:

* **Wide-area coverage:** It is anticipated that a single platform would be able to serve footprints larger than 100 km in diameter, and recent technological advances in the development of optical inter-HAPS links now allow the deployment of multiple linked HAPS, in fleets that can cover whole nations.
* **Low cost:** The cost of operating stratospheric platforms is projected to be significantly lower than other connectivity solutions in many areas, while mass production of the aircraft will significantly lower upfront capital expenditure for deployment.
* **Reach:** HAPS platforms operate at around 20 km above ground, which reduces their vulnerability to weather conditions that may affect service, provides large coverage areas and avoids interference caused by physical obstacles.
* **Rapid deployment and flexibility:** HAPS services could be deployed without long lead times and it is relatively simple to return solar platforms to the ground for maintenance or payload reconfiguration.
* **Geographical reach:** HAPS that use the architecture of solar platforms can also provide connectivity in remote sites on land or sea.
* **Environmentally friendly:** HAPS can run exclusively on solar power for long periods, connecting people with almost no environmental impact.

Broadband HAPS can also be used for response to natural disasters, fire detection, monitoring, and firefighting, law enforcement, and resource exploration missions.

**SHARING STUDIES**

A number of administrations and technology proponents have conducted compatibility studies to assess coexistence between HAPS and incumbent and proposed systems and services (including WRC-19 Agenda Items 1.6 and 1.13).

Power-flux density (PFD) masks are proposed to ensure the protection of the fixed and mobile services from downlink emissions by HAPS platforms (HAPS-to-ground), which if exceeded would require explicit agreement from affected administrations. However, these studies have not yet concluded. For example, in 25.25-27.5 GHz, sharing studies with the Mobile Service to date have only been conducted for two of the six proposed HAPS systems: it should be noted that the systems studied have a CPE density of 16 and 32 CPEs, while other systems which have not been studied include one system that has a CPE density of 12,663 CPEs. In the 47.2-47.5 GHz and 47.9-48.2 GHz bands, there is not even agreement on which Recommendations to use for characteristics of the Fixed Service. Furthermore, two HAPS proponents have assessed the prospects for sharing with mobile operations in the 26 GHz band in the United States, and concluded that “IMT cannot share the spectrum without causing unacceptable interference or imposing unreasonable constraints” on their proposed operations.[[1]](#footnote-1)

…

These proposals provide appropriate modifications to the existing footnotes and associated resolutions in the existing HAPS identifications in order to facilitate the use of HAPS links on a global or regional level, limited to the currently identified frequency bands, consistent with Resolution 160 (WRC-15). Furthermore, it should be noted that these proposals do not include a compliance mask, which can be addressed at the national level.

**Proposals:**

ADD USA/1.14/12

**5.D114** The allocation to the fixed service in the bands 25.25-25.5 GHz, 25.5-27.0 GHz and 27.0-27.5 GHz may also be used in Region 2 by high-altitude platform stations (HAPS): this does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Such use of the fixed-service allocation by HAPS is limited to operation in the HAPS-to-ground and ground-to-HAPS in the frequency range 25.25-27 GHz, and HAPS-to-ground only in the band 27.0-27.5 GHz. Such use of the fixed-service allocation by HAPS shall be in accordance with Resolution **[C114] (WRC-19)**. Furthermore, the future development of these other services shall not be constrained by HAPS.

**Reasons:** To add the text of the footnote allowing HAPS to operate in the fixed service allocation in the 25.25-27.55 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 operating in the same band.

ADD USA/1.14/13

DRAFT NEW RESOLUTION [C114]

**Use of the frequency range 24.25-27.5 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 is one possible means to provide broadband connectivity and disaster recovery communications;

*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 designations were established without reference to today’s broadband capabilities;

*c)* that HAPS can provide broadband connectivity with minimal ground network infrastructure;

*recognizing*

1. 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**;
2. that in the band 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, Nos. **9.17** and **9.18** applies;

*resolves*

1 that for the purpose of protecting the fixed service systems in neighboring administrations in the frequency range 24.25-27.5 GHz, the power flux density level per HAPS platform station at the surface of the Earth in neighboring administrations shall not exceed the following pfd mask in dBW/m2/MHzwithout the explicit agreement from the affected administration:

where El is the elevation angle in degrees (angles of arrival above the horizontal plane).

[NOTE TO FCC: The mask above should be confirmed or revised, using the correct formula and relevant ITU-R Recommendations, once the correct Recommendation to use is identified.]

2 that for the purpose of protecting the terrestrial mobile service systems in neighboring administrations in the band 24.25-27.5 GHz, the power flux density level per HAPS platform station or individual HAPS ground station at the surface of the Earth in neighboring administrations shall not exceed the following pfd masks in dBW/m2/MHz without the explicit agreement from the affected administration:

PFD(δ) = -113.3 (dBW/m2/1 MHz) for 0° ≤ δ ≤ 4°

PFD(δ) = -113.3 + 1.2 \* (δ - 4) (dBW/m2/1 MHz) for 4° < δ ≤ 9°

PFD(δ) = -107.3 (dBW/m2/1 MHz) for 9° < δ ≤ 90°

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

3 that HAPS stations shall not claim protection from Fixed or Mobile Service stations transmitting in the bands 25.25-27.5 GHz and No. 5.43A shall not apply;

**4 …**

**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.

MOD USA/1.14/15

5.537A The allocation to the fixed service in the band 27.9-28.2 GHz may also be used by high altitude platform stations (HAPS): this does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Such use of 300 MHz of the fixed-service allocation by HAPS is further limited to operation in the HAPS-to-ground direction and shall not cause unacceptable interference to, nor claim protection from, other types of fixed-service systems or systems operating under other co-primary services. Furthermore, the development of these other services shall not be constrained by HAPS. See Resolution **145 (Rev.WRC‑19)**.

MOD USA/1.14/20

RESOLUTION 145 (Rev.WRC‑19)

Use of the bands 27.9-28.2 GHz and 31-31.3 GHz by   
high altitude platform stations in the fixed service

The World Radiocommunication Conference (Geneva, 2012),

considering

*a)* that WRC‑97 made provision for the operation of high altitude platform stations (HAPS), also known as stratospheric repeaters, within a 2 x 300 MHz portion of the fixed-service allocation in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

*b)* that No. **4.23** specifies that transmissions to or from HAPS shall be limited to the bands specifically identified in Article **5**;

*c)* that at WRC‑2000, several countries in Region 3 and one country in Region 1 expressed a need for a lower frequency band for HAPS due to the excessive rain attenuation that occurs at 47 GHz in these countries;

*d)* that some countries in Region 2 have also expressed an interest in using a frequency range lower than those referred to in *considering a)*;

*e)* that, in order to accommodate the need expressed by the countries referred to in *considering c)*,WRC‑2000 adopted Nos. **5.537A** and **5.543A**, which were modified at WRC‑03 and then again at WRC‑07 to permit the use of HAPS in the fixed service in the band 27.9-28.2 GHz and in the band 31-31.3 GHz in certain Region 1 and 3 countries on a non-harmful interference, non‑protection basis;

*f)* that the bands 27.9-28.2 GHz and 31-31.3 GHz are already heavily used or planned to be used by a number of different services and a number of other types of applications in the fixed service;

*g)* that while the decision to deploy HAPS can be taken on a national basis, such deployment may affect neighbouring administrations, particularly in small countries;

*h)* that the 31.3-31.8 GHz band is allocated to the radio astronomy, Earth exploration-satellite (passive) and space research (passive) services, and that WRC‑03 amended No. **5.543A** to specify signal levels that would protect satellite passive services and radio astronomy stations;

*i)* that ITU‑R has conducted studies dealing with sharing between systems using HAPS in the fixed service and other types of systems in the fixed service in the bands 27.9-28.2 GHz and 31‑31.3 GHz leading to Recommendation ITU‑R F.1609;

*j)* that results of some ITU‑R studies indicate that, in the bands 27.9-28.2 GHz and 31‑31.3 GHz, sharing between fixed-service systems using HAPS and other conventional fixed-service systems in the same area will require appropriate interference mitigation techniques to be developed and implemented;

*k)* that ITU‑R has conducted studies dealing with compatibility between systems using HAPS and the passive services in the 31.3-31.8 GHz band leading to Recommendations ITU‑R F.1570 and ITU‑R F.1612;

*l)* that ITU‑R has produced Recommendation ITU‑R SF.1601 containing methodologies for evaluating interference from fixed-service systems using HAPS into GSO FSS systems in the band 27.9-28.2 GHz;

*m)* that HAPS technical issues could continue to be studied in order to determine appropriate measures for protecting the fixed service and other co-primary services in the band 27.9-28.2 GHz,

resolves

1 that, notwithstanding No. **4.23**, the use of HAPS within the fixed-service allocations within the 27.9-28.2 GHz and 31-31.3 GHz bands shall not cause harmful interference to, nor claim protection from, other stations of services operating in accordance with the Table of Frequency Allocations of Article **5**, and, further, that the development of these other services shall proceed without constraints by HAPS operating pursuant to this Resolution;

2 that any use by HAPS of the fixed-service allocation at 27.9-28.2 GHz pursuant to *resolves*1 above shall be limited to operation in the HAPS-to-ground direction, and that any use by HAPS of the fixed-service allocation at 31-31.3 GHz shall be limited to operation in the ground-to-HAPS direction;

2 bis that systems using HAPS in the band 27.9-29.2 GHz, in accordance with resolves 1 above, shall not cause unacceptable interference to the fixed service having a primary allocation in the band 27.5-29.5 GHz, the power flux density limit per HAPS platform station at the surface of the Earth in neighboring administrations shall not exceed the following pfd mask in dBW/m2/MHz without the explicit agreement from the affected administration:

[NOTE TO FCC: This mask should be provided, using the correct formula and relevant ITU-R Recommendations, once the correct Recommendation to use is identified.]

2 ter that systems using HAPS in the band 27.9-29.2 GHz, in accordance with resolves 1 above, shall not cause unacceptable interference to the mobile service having a primary allocation in the band 27.5-29.5 GHz. The power flux density per HAPS platform station at the surface of the Earth in neighboring administrations shall not exceed the following pfd masks in dBW/m2/MHz without the explicit agreement from the affected administration

PFD(δ) = -122.7 (dBW/m2/1 MHz) for 0° ≤ δ ≤ 2°

PFD(δ) = -122.7 + 2 \* (δ - 2) (dBW/m2/1 MHz) for 2° < δ ≤ 2.3°

PFD(δ) = -122.6 + 1.5 \* (δ - 2)(dBW/m2/1 MHz) for 2.3° < δ ≤ 7.9°

PFD(δ) = -113.9 (dBW/m2/1 MHz) for 7.9° < δ ≤ 90°

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

3 that systems using HAPS in the band 31-31.3 GHz, in accordance with *resolves*1 above, shall not cause harmful interference to the radio astronomy service having a primary allocation in the band 31.3-31.8 GHz, taking into account the protection criterion given in the relevant ITU‑R Recommendation in the RA series. In order to ensure the protection of satellite passive services, the level of unwanted power density into the HAPS ground station antenna in the band 31.3-31.8 GHz shall be limited to −106 dB(W/MHz) under clear-sky conditions and may be increased up to −100 dB(W/MHz) under rainy conditions to mitigate fading due to rain, provided that the effective impact on the passive satellite does not exceed the impact under clear-sky conditions

3 bis that for the purpose of protecting the fixed service systems in neighbouring administrations in the band 31-31.3 GHz, the power flux density limit per HAPS platform station at the surface of the Earth in neighbouring administrations shall not exceed the following pfd mask in dBW/m2/MHz, without the explicit agreement from the affected administration:

[NOTE TO FCC: This mask should be ,provided, using the correct formula and relevant ITU-R Recommendations, once the correct Recommendation to use is identified.]

4 that the administrations which intend to implement systems using HAPS in the fixed service in the bands 27.9-28.2 GHz and 31-31.3 GHz shall seek explicit agreement of concerned administrations with regard to their stations of primary services to ensure that the conditions in this Resolution are met, and those administrations which intend to implement systems using HAPS in the fixed service in these bands shall seek explicit agreement of concerned administrations with regard to their stations of services operating in accordance with the Table of Frequency Allocations of Article **5** to ensure that the conditions in *resolves*1and *resolves*3 are met;

5 that administrations planning to implement a HAPS system pursuant to *resolves*1 above shall notify the frequency assignment(s) by submitting all mandatory elements of Appendix **4** to the Radiocommunication Bureau for the examination of compliance with *resolves*3 and 4 above,

invites ITU‑R

1 to continue to carry out studies on the appropriate interference mitigation techniques for the situations referred to in *considering j)*;

2 to develop protection criteria for the mobile service having primary allocations in the frequency bands 31-31.3 GHz from HAPS in the fixed service.

ADD USA/1.14/22

**5.G114** The allocation to the fixed service in the band 38-39.5 GHz may also be used by high-altitude platform stations (HAPS): this does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Such use of the fixed-service allocation by HAPS shall be in accordance with Resolution **[G114] (WRC-19)**. Such use of the fixed-service allocation by HAPS is limited to the ground-to-HAPS direction.Furthermore, the development of these other services shall not be constrained by HAPS.

**Reasons:** To add the text of the footnote allowing HAPS to operate in the fixed service allocation in the 38-39.5 GHz band on a worldwide basis.

ADD USA/1.14/23

DRAFT NEW RESOLUTION [G114]

**Use of the frequency range 38-39.5 GHz by fixed links for high altitude   
platform stations in the fixed service worldwide**

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 is one possible means to provide broadband connectivity and disaster recovery communications

*b)* that WRC-15 decided to study additional spectrum needs for fixed HAPS links to provide broadband connectivity, including within the band 38 – 39.5 GHz, recognizing that the existing HAPS designations were established without reference to today’s broadband capabilities;

*c)* that HAPS can provide broadband connectivity with minimal ground network infrastructure;

*Recognizing*

*a)* that the use of HAPS in this band is intended for the ground to HAPS direction;

;

*Resolves*

1 that for the purpose of protecting the fixed service systems in neighbouring administrations in the band 38-39.5 GHz, the power flux density limit per HAPS platform station at the surface of the Earth in neighbouring administrations shall not exceed the following pfd mask in in dBW/m2/MHz, under clear sky condition, without the explicit agreement from the affected administration:

[NOTE TO FCC: This mask should be ,provided, using the correct formula and relevant ITU-R Recommendations, once the correct Recommendation to use is identified.]

1bis that for the purpose of protecting terrestrial mobile service systems in neighboring administrations in the frequency range 38-39.5 GHz, the power flux density limit per HAPS ground station at the surface of the Earth in neighboring administrations shall not exceed the following pfd masks in dBW/m2/MHz without the explicit agreement from the affected administration:

PFD(δ) = -110.8 (dBW/m2/1 MHz) for 0° ≤ δ ≤ 4°

PFD(δ) = -110.8 + 1.5 \* (δ - 4) (dBW/m2/1 MHz) for 4° < δ ≤ 11.5°

PFD(δ) = -101.8 (dBW/m2/1 MHz) for 11.5° < δ ≤ 90°

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

…3that HAPS platforms shall not claim protection from FSS satellite stations, fixed service stations, or mobile service stations transmitting in the 38-39.5 GHz band, and No. 5.43A shall not apply;

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

MOD USA/1.14/25

5.552A The allocation to the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz may be used by gateways for high altitude platform stations (HAPS): this does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. Such use of the fixed-service allocation by HAPS is limited to the ground-to-HAPS direction. The use of the bands 47.2-47.5 GHz and 47.9‑48.2 GHz shall be in accordance with Resolution **122 (Rev.WRC-19)**.

**Reasons:** To modify footnote 5.552A to provide clarity about the use of the band by applications of the fixed and other service and reflect an updated Resolution 122 with allowances for increases in EIRP density levels during periods of rain and to limit operation to the ground-to-HAPS direction

MOD USA/1.14/26

RESOLUTION 122 (rev.WRC‑19)

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

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

*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 some countries have notified such systems to ITU in the bands 47.2-47.5 GHz and 47.9-48.2 GHz;

e) 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;

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

g) 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;

i) 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;

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

k) 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 gateway;

*b)* that 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 20 dB during periods of rain;

*e)* that ITU‑R studies have established specific power flux‑density values to be met within the territory of a neighbouring country to facilitate bilateral agreement on sharing conditions for HAPS with other types of fixed service systems in a neighboring country;

*f)* that FSS satellite networks and systems with earth station antenna diameters of 2.5 meters or larger operating as a gateway-type station are capable of sharing with ubiquitous HAPS 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 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 terminal elevation angle in degrees;

2 that the values in *resolves 1* can be increased, up to 20 dB, to compensate for rain fade provided that the pfd at the space station does not exceed the value that would result when transmitting with the levels in *resolves 1* in clear sky condition;

3 that the ground 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*(ϕ) = *Gmax* − 2.5 × 10−3  for 0° < ϕ < ϕ*m*

*G*(ϕ) = 39 − 5 log (*D*/λ) − 25 log ϕ for ϕ*m* ≤ ϕ < 48°

*G*(ϕ) = −3 − 5 log (*D*/ λ) for 48° ≤ ϕ ≤ 180°

where:

*Gmax* :maximum antenna gain (dBi)

*G*(ϕ) :gain (dBi) relative to an isotropic antenna

ϕ : off-axis angle (degrees)

 expressed in the same units

 degrees

*G* : gain of the first side lobe

2  15 log (*D*/) (dBi);

4 that for the purpose of protecting fixed wireless systems in neighbouring administrations from co‑channel interference, 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 in a neighbouring territoryunless explicit agreement of the affected administration is provided at the time of the notification of HAPS:

−141 dB(W/(m2 · MHz)) for  0° ≤ δ < 3°

−141 + 2(δ − 3) dB(W/( m2 · MHz)) for  3° ≤ δ ≤ 13°

−121 dB(W/( m2 · MHz)) for 13° < δ ≤ 90°

where δ is the angle of the arrival above the horizontal plane in degrees;

[NOTE TO FCC: THIS MASK SHOULD BE CONFIRMED BASED UPON CORRECT FORMULA AND RELEVANT ITU-R RECOMMENDATIONS.]

5that 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 in a neightouring territory without the explicit agreement of the affected administrations:−109  dB(W/(m2 · MHz)) for    0°  ≤ θ ≤   4°

−109 + 1.2 (θ −4)     dB(W/(m2 · MHz)) for    4°  < θ ≤ 11.5°

−100  dB(W/(m2 · MHz)) for  11.5°  < θ ≤ 90°

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

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 and 5 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 terminals,

instructs the Director of the Radiocommunication Bureau

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:** To modify the existing Resolution 122 which supports a worldwide designation to HAPS to allow for increases in EIRP density levels during periods of rain.

**SUP** **USA/1.14/27**

Resolution 160 (WRC‑15)

Facilitating access to broadband applications delivered   
by high-altitude platform stations

**Reasons:** The work associated with Resolution 122 is completed.

1. Petition for Rulemaking of Elefante Group, Inc., *Petition for Rulemaking to Enable Fixed Stratospheric-Based Communications Services in the 21.5-23.6, 25.25-27.5, 71-76, and 81-86 GHz Bands*, RM-11809, at 75 n.98 (filed May 31, 2018), <https://ecfsapi.fcc.gov/file/10531779304408/Elefante%20Group%20Petition%20for%20Rulemaking%205-31-2018.pdf>; *see also* Comments of Elefante Group, Inc., *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, GN Docket NO. 14-177, at 63-68 (filed Sept. 10, 2018), <https://ecfsapi.fcc.gov/file/1091164700443/Elefante%20Group%20Comments%20on%20Spectrum%20Frontiers%203rd%20FNPRM%20(FINAL%209-10-18).pdf>. [↑](#footnote-ref-1)