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| **World Radiocommunication Conference (WRC-19) Sharm el-Sheikh, Egypt, 28 October – 22 November 2019** |  |
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| PLENARY MEETING | **Addendum 14 to Document 12-E** |
|  | **2 October 2019** |
|  | **Original: Russian** |
|  | |
| Regional Commonwealth in the field of Communications Common Proposals | |
| 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;

Introduction

The RCC Administrations consider that, in examining agenda item 1.14, protection and the possibility of further development must be ensured for existing services, including other applications of the fixed service with allocations in these and adjacent frequency bands.

The RCC Administrations, in respect of the frequency bands under study, support regulatory actions based on the following methods:

|  |  |
| --- | --- |
| Frequency bands | Preferred methods of addressing the agenda item |
| 6 440-6 520 MHz | Method A of the CPM Report (NOC) |
| 6 560-6 640 MHz | Method A of the CPM Report (NOC) |
| 21.4-22 GHz (Region 2) | If Method B of the CPM Report is applied:  Draft Resolution **[RCC-21GHz] (WRC-19)**, ensuring protection of EESS (passive) in the frequency bands 21.2-21.4 GHz and 22.21-22.5 GHz. |
| 24.25-27.5 GHz (Region 2) | If Method B of the CPM Report is applied:  Draft Resolution **[RCC-24-27 GHz] (WRC-19)**, ensuring protection of the inter-satellite service in the frequency bands 24.45-24.75 GHz and 25.25-27.5 GHz, EESS (passive) in the frequency band 23.6-24 GHz, EESS and SRS (space-to-Earth) in the frequency band 25.5-27 GHz, and FSS in the frequency bands 24.75-25.25 GHz and 27-27.5 GHz. |
| 27.9-28.2 GHz | Method B1 in the CPM Report (Option 1, modified to ensure protection of existing services) |
| 31-31.3 GHz | Method B1 in the CPM Report (Option 1B, modified to ensure protection of existing services) |
| 38-39.5 GHz | Method A in the CPM Report (NOC) |
| 47.2-47.5 GHz and 47.9-48.2 GHz | Method B1 in the CPM Report (modifications to RR No. **5.552A** in accordance with Example 2 and modifications to Resolution **122 (Rev.WRC‑07)** to reflect Examples 1 + 2) |

The RCC Administrations consider that any possible identification and allocation for use by HAPS in the radiofrequency bands 21.4-22 GHz and 24.25-27.5 GHz in Region 2 under this agenda item for WRC-19 shall be accompanied by appropriate protection for the inter-satellite service in the frequency bands 24.45-24.75 GHz and 25.25-27.5 GHz, EESS (passive) in the frequency bands 21.2-21.4 GHz, 22.21-22.5 GHz and 23.6-24 GHz, EESS and SRS (space-to-Earth) in the frequency band 25.5-27 GHz, and FSS in the frequency bands 24.75-25.25 GHz and 27-27.5 GHz.

ARTICLE 5

Frequency allocations

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

NOC RCC/12A14/1

5 570-6 700 MHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 5 925-6 700 FIXED 5.457  FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B  MOBILE 5.457C  5.149 5.440 5.458 | | |

**Reasons:** No changes, given the need to maintain protection conditions for existing services.

NOC RCC/12A14/2#49729

RESOLUTION 150 (WRC‑12)

Use of the bands 6 440-6 520 MHz and 6 560-6 640 MHz by gateway links   
for high-altitude platform stations in the fixed service

**Reasons:** No changes, given the need to maintain protection conditions for existing services.

ADD RCC/12A14/3#49749

DRAFT NEW RESOLUTION [RCC/21GHZ] (WRC‑19)

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

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

considering

....

recognizing

....

resolves

...

2 that in order to ensure the protection of EESS (passive), the e.i.r.p. density in the bands 21.2-21.4 GHz and 22.21-22.5 GHz, per HAPS operating in the 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 angle of arrival of the incident wave in degrees;

...

instructs the Director of the Radiocommunication Bureau

...

**Reasons:** Revision of regulatory measures shall be accompanied by protection of the EESS (passive) operating in the frequency bands 21.2-21.4 GHz and 22.21-22.5 GHz.

ADD RCC/12A14/4#49757

DRAFT NEW RESOLUTION [RCC/24-27GHz] (WRC‑19)

Use of the bands 24.25-27.5 GHz by high-altitude platform stations   
in the fixed service in Region 2

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

considering

*...*

recognizing

*...*

resolves

*...*

3 that for the purpose of protecting the inter-satellite service, the e.i.r.p. density per HAPS in the bands 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/Hz) for off-nadir angle higher than 85.5°;

5 that for the purpose of protecting the inter‑satellite service, the maximum e.i.r.p. density in the band 25.25-25.5 GHz density of HAPS ground stations shall not exceed 0.5 dB(W/MHz) in clear-sky conditions in the direction of inter-satellite service space stations on geostationary orbit.

Specific GSO positions which need to be protected are contained in latest version of Recommendation ITU-R SA.1276, it is also necessary to take into account possible orbit inclination of space stations between −5° and 5°.

Automatic power control may be used to increase the e.i.r.p. density to compensate for rain attenuation, to the extent that interference into space station of inter-satellite service does not exceed the value resulting from use by HAPS ground stations of an e.i.r.p. density, meeting the above limits in clear-sky conditions;

6 that for the purpose of protecting the fixed-satellite service, the e.i.r.p. density per HAPS platform, in the bands 24.75-25.25 GHz and 27-27.5 GHz, shall not exceed −9.1 dBW/MHz for off‑nadir angles higher than 85.5°;

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

−0.7714 θ − 16.5 dB(W/200 MHz) for −4.53° ≤ θ < 35°

−43.5 dB(W/200 MHz) for 35° ≤ θ ≤ 90°

where θ is the angle of arrival of the incident wave in degrees;

8 that with respect to HAPS ground stations using the frequency band 25.5-27 GHz, the provisions of No. **5.536A** shall not apply;

9 that, in order to ensure the protection of in-band SRS/EESS satellite services from the HAPS gateway in the band 25.5-27 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.

NOTE –The case of protection of typical EESS and SRS earth stations may require further clarification.

SRS

−138.8 + 25 \* log10(5 − θ) dB(W/(m2 · MHz)) for 0° ≤ θ < 4.925°

−166.9 dB(W/(m2 · MHz)) for 4.925° ≤ θ < 5°

−183.9 dB(W/(m2 · MHz)) for 5° ≤ θ < 90°

where (θ) is the angle of arrival (φ) of the interfering signal above the local horizontal plane at the SRS antenna

EESS non-GSO

−108.8 + 25 \* log10(3 − θ) dB(W/(m2 · MHz)) for 0° ≤ θ < 2.808°

−126.7 dB(W/(m2 · MHz)) for 2.808° ≤ θ < 3°

−143.4 dB(W/(m2 · MHz)) for 3° ≤ θ < 90°

where (θ) is the angle of arrival (φ) of the interfering signal above the local horizontal plane at the SRS antenna.

EESS GSO

−140.5 + 25 \* log10(3 − θ) dB(W/(m2 · MHz)) for 0° ≤ θ < 2.808°

−158.4 dB(W/(m2 · MHz)) for 2.808° ≤ θ < 3°

−178.5 dB(W/(m2 · MHz)) for 3° ≤ θ < 90°

where (θ) is the angle of arrival (φ) of the interfering signal above the local horizontal plane at the EESS antenna.

For the HAPS ground station towards an SRS/EESS earth station, attenuation using the relevant ITU-R propagation Recommendations shall be applied using the following percentages: 1) SRS: .001%; 2) EESS non-GSO: .005%; 3) EESS GSO: 20%, and the HAPS and SRS/EESS antenna heights shall be used in this calculation;

...

instructs the Director of the Radiocommunication Bureau

...

**Reasons:** Revision of regulatory measures shall be accompanied by protection of the inter-satellite service in the band 24.45-24.75 GHz, the inter-satellite service in the frequency band 25.25-27.5 GHz, EESS (passive) in the band 23.6-24 GHz, EESS and SRS (space-to-Earth) in the band 25.5-27 GHz, and FSS in the bands 24.75-25.25 GHz and 27-27.5 GHz.

ARTICLE 5

Frequency allocations

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

MOD RCC/12A14/5#49766

24.75-29.9 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 27.5-28.5 FIXED ADD 5.E114  FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539  MOBILE  5.538 5.540 | | |

**Reasons:** Suppression in RR No. **5.537A** and addition of new RR No. **5.E114**.

ADD RCC/12A14/6#49769

5.E114 The allocation to the fixed service in the 27.9-28.2 GHz band is identified for worldwide use by administrations wishing to implement high-altitude platform stations (HAPS). Such use of the fixed-service allocation by HAPS shall not cause harmful interference to, nor claim protection from, other types of fixed-service systems or other co-primary services. Furthermore, the development of these other services shall not be constrained by HAPS. The use of the fixed service allocation by HAPS is limited to operation in the HAPS-to-ground direction and is subject to the provisions of Resolution **[RCC/28/31GHZ] (WRC‑19)**.     (WRC‑19)

**Reasons:** Revision of regulatory measures for HAPS in the frequency band 27.9-28.2 GHz subject to protection of other types of systems in the fixed service and other services to which the band in question is allocated on a primary basis.

SUP RCC/12A14/7#49768

5.537A

**Reasons:** Suppressed as a result of the addition of new RR No. **5.E114**.

ADD RCC/12A14/8#49771

DRAFT NEW RESOLUTION [RCC/28/31ghZ] (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 (Sharm el-Sheikh, 2019),

considering

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

*b)* 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;

*c)* that HAPS deployment in the band 27.9-28.2 GHz is intended to provide connectivity from the HAPS to a limited number of HAPS ground stations per beam;

*d)* that WRC‑15 decided to study additional spectrum needs for fixed HAPS links to provide broadband connectivity on a global basis, including within the bands 27.9-28.2 GHz and 31-31.3 GHz, recognizing that the existing HAPS identifications were established without reference to today’s broadband capabilities;

*e)* 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 Report ITU‑R F.[HAPS-31 GHz];

*f)* 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 Report ITU‑R F.[HAPS-31 GHz];

*g)* that Report ITU‑R F.2438 contains worldwide spectrum needs of HAPS systems;

*h)* that Report ITU‑R F.2439 has updated deployment and technical characteristics of broadband HAPS systems to complete feasibility, sharing and compatibility studies between HAPs and other affected services,

recognizing

that in the band 27.9-28.2 GHz with respect to transmitting 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,

resolves

1 that for the purpose of protecting the fixed wireless systems in territory of other administrations in the band 27.9-28.2 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 under clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

3 θ − 140 dB(W/(m² · MHz)) for 0° ≤ θ < 10°

0.57 θ − 115.7 dB(W/(m² · MHz)) for 10° ≤ θ < 45°

−90 dB(W/(m² · MHz)) for 45° ≤ θ < 90°

where θ is the angle of arrival of the incident wave in degrees.

In order to compensate for additional propagation impairments in the boresight of any beam of the HAPS due to rain, the HAPS can be operated so that the pfd mask can be increased in any corresponding beam (i.e. suffering the rain fade) by a value only equivalent to the level of rain fading and limited to a maximum of 20 dB.

To verify the compliance with the proposed pfd mask the following equation shall be used:



where:

*d*: is the distance in metres between the HAPS and the ground (dependent to the elevation angle);

*e.i.r.p.*: HAPS nominal e.i.r.p. spectral density in dB(W/MHz) at a specific elevation angle;

*pfd*(θ):power flux-density at the Earth’s surface per HAPS in dB(W/(m2 · MHz));

2 that for the purpose of protecting the mobile service systems in territory of other administrations in the band 27.9-28.2 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, under clear-sky conditions, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

θ − 120 dB(W/(m² · MHz)) for 0°< θ ≤ 13°

−107 dB(W/(m² · MHz)) for 13° < θ ≤ 65°

0.68 θ −151.2 dB(W/(m² · MHz)) for 65° < θ ≤ 90°

where θ is the angle of arrival of the incident wave in degrees.

In order to compensate for additional propagation impairments in the boresight of any beam of the HAPS due to rain, the HAPS can be operated so that the pfd mask can be increased in any corresponding beam (i.e. suffering the rain fade) by a value only equivalent to the level of rain fading.

To verify the compliance with the proposed pfd mask the following equation shall be used:



where:

*d*: distance in metres between the HAPS and the ground (dependent to the elevation angle θ);

*e.i.r.p.*: HAPS nominal e.i.r.p. spectral density in dB(W/MHz) at a specific elevation angle;

*pfd*(θ): power flux-density at the Earth’s surface per HAPS in dB(W/(m2 · MHz));

3 that for the purpose of protecting the fixed-satellite service (Earth-to-space) in the 27.9‑28.2 GHz, the maximum e.i.r.p. density per HAPS downlink shall be less than −9.7 dB(W/MHz) in any direction for off-nadir angle higher than 85.5°;

4 that in order to ensure the protection of EESS (passive), the level of unwanted power density in the band 31.3-31.8 GHz into the antenna of a HAPS ground station operating in the band 31-31.3 GHz, shall be limited to −83 dB(W/200 MHz) under clear-sky conditions and may be increased 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;

5 that in order to ensure the protection of the radio astronomy service, the power flux-density level produced by any HAPS ground station at the RAS stations locations at a height of 50 m, shall not exceed −141 dB(W/(m2 · 500 MHz)) in the band 31.3-31.8 GHz. This limit relates to the power flux-density which would be obtained under assumed propagation conditions predicted by Recommendation ITU‑R P.452 using a time percentage of 2%;

6 that *resolves* 5 applies at any radio astronomy station that was in operation prior to 22 November 2019 and has been notified to the Bureau in the band 31.3-31.8 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* 7 applies. Radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS;

7 that administrations planning to implement a HAPS system in the in the bands 27.9‑28.2 GHz and 31-31.3 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 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:** The development of a new Resolution setting out regulatory measures for the operation of HAPS in the frequency bands 27.9-28.2 GHz and 31-31.3 GHz. Proposed modifications to Article 5 with regard to the frequency band 31-31.3 GHz are set out below.

ARTICLE 5

Frequency allocations

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

MOD RCC/12A14/9#49778

29.9-34.2 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 31-31.3 FIXED 5.338A ADD 5.F114  MOBILE  Standard frequency and time signal-satellite (space-to-Earth)  Space research 5.544 5.545  5.149 | | |

**Reasons:** Suppression in RR No. **5.543A** and addition of new RR No. **5.F114**.

ADD RCC/12A14/10#49783

5.F114 The allocation to the fixed service in the 31-31.3 GHz band is identified for worldwide use by administrations wishing to implement high-altitude platform stations (HAPS) in the HAPS-to-ground direction. Such use of the fixed-service allocation by HAPS shall not cause harmful interference to, nor claim protection from, other types of fixed-service systems or other co‑primary services. Furthermore, the development of these other services shall not be constrained by HAPS. Use of the band is subject to the provisions of Resolution **[RCC/28/31GHZ] (WRC‑19)**.     (WRC‑19)

**Reasons:** Revision of regulatory measures for HAPS in the frequency band 31-31.3 GHz subject to protection of other types of systems in the fixed service and other services.

SUP RCC/12A14/11#49784

5.543A

**Reasons:** Suppressed as a result of the addition of two new notes.

NOC RCC/12A14/12

34.2-40 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| 38-39.5 FIXED  FIXED-SATELLITE (space-to-Earth)  MOBILE  Earth exploration-satellite (space-to-Earth)  5.547 | | |

**Reasons:** No changes, given the need to maintain protection conditions for existing services.

MOD RCC/12A14/13#49798

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  MOD 5.552A | | |

**Reasons:** Changes to regulatory measures for HAPS in RR No. **5.552A**.

MOD RCC/12A14/14#49799

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  MOD 5.552A | | |

**Reasons:** Changes to regulatory measures for HAPS in RR No. **5.552A**.

MOD RCC/12A14/15#49801

5.552A The allocation to the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz is 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. Such use of the fixed-service allocation in the bands 47.2-47.5 GHz and 47.9-48.2 GHz by HAPS shall be in accordance with the provisions of Resolution **122 (Rev.WRC‑19)**.     (WRC‑19)

**Reasons:** Changes to RR No. **5.522A** resulting from the revision of regulatory measures for HAPS in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz subject to protection of other services to which this band is allocated on a primary basis.

MOD RCC/12A14/16#49802

RESOLUTION 122 (rev.WRC‑19)

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

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

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 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;

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

*f)* 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;

*g)* 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;

*h)* 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;

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

*j)* 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;

*b)* that Recommendation ITU‑R SF.1843 provides information on the feasibility of HAPS systems in the fixed service sharing with the FSS;

*c)* 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;

*d)* 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 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 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 conditions;

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)

4 that for the purpose of protecting fixed wireless systems in the territory of other administrations from co‑channel interference, the power flux-density level produced at the Earth’s surface per HAPS in any part of the bands 47.2-47.5 GHz and 47.9-48.2 GHz shall not exceed the following limits under clear-sky conditions, unless explicit agreement of the affected administration is provided at the time of the notification of HAPS:

−141 dB(W/(m² · MHz)) for θ ≤ 3°

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

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

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

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

8 that for the purpose of protecting systems in the mobile service in territory of other 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 limits at the Earth’s surface applied at the border of the territory of other administrations without the explicit agreement of the affected administrations:

−109 dB(W/(m² · MHz)) for 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 θ is the angle of arrival above the horizontal plane for HAPS space station and below the horizon for the HAPS ground station,

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

to take all necessary measures to implement this Resolution.

**Reasons:** Revision of regulatory measures for HAPS in the frequency bands 47.2-47.5 GHz and 47.9-48.2 GHz.

SUP RCC/12A14/17#49813

RESOLUTION 160 (WRC-15)

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

**Reasons:** The Resolution has been implemented

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