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| **World Radiocommunication Conference (WRC-19)Sharm el-Sheikh, Egypt, 28 October – 22 November 2019** |  |
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| COMMITTEE 4 | **Document 406-E** |
|  | **17 November 2019** |
|  | **Original: English** |
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| Working Group 4BAd-hoc Group on Agenda Item 1.14 |
| PROPOSALS RELATING TO AGENDA ITEM 1.14 |
|  |
| 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;

For the frequency band 38-39.5 GHz, the Ad-hoc Group agreed to the changes to the Radio Regulations as indicated in the Annex. The proposals on modifications to the Article **11**, Appendix **4**, Appendix **7** and Resolution **160 (WRC‑15)** for the band above will be available separately.

 Mr Marc Girouard
 Chairman, Ad-hoc Group on Agenda item 1.14
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Alternative 1 (NOC)

ARTICLE 5

Frequency allocations

NOC WG4B/406/1

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

Alternative 2

(Worldwide identification HAPS to ground and ground to HAPS)

MOD WG4B/406/2#72841

34.2-40 GHz

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| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 38-39.5 FIXED ADD 5.G114 FIXED-SATELLITE (space-to-Earth) MOBILE Earth exploration-satellite (space-to-Earth) 5.547 |

ADD WG4B/406/3#50574

5.G114 The allocation to the fixed service in the band 38-39.5 GHz is identified for worldwide use by high-altitude platform stations (HAPS). This identification does not preclude the use of this frequency band by other fixed service applications or by other services to which this band is allocated on a co-primary basis and does not establish priority in the Radio Regulations. Such use of the fixed-service allocation by HAPS shall be in accordance with the provisions of Resolution **[TBD] (WRC‑19)**.     (WRC‑19)

ADD WG4B/406/4#72623

draFt new RESOLUTION [TBD] (WRC‑19)

Use of the band 38-39.5 GHz by high altitude platform
stations in the fixed service

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

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 ITU-R to study additional spectrum needs for fixed HAPS links to provide broadband connectivity and to facilitate the use of HAPS linkson 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 Report ITU-R F.2439 contains updated deployment and technical characteristics of broadband HAPS systems;

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

*f)* that ITU‑R has conducted studies dealing with compatibility between systems using HAPS and existing services in the 38-39.5 GHz frequency band leading to Report ITU‑R F.2475;

 *considering further*

that current technologies, such as high-altitude platform stations (HAPS), can be used to deliver broadband applications for broadband connectivity and disaster recovery communications with minimal ground network infrastructure,

 *recognizing*

*a)* that during periods of rain, the e.i.r.p. of the HAPS’ 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. under clear sky conditions declared in the Appendix 4,

*b)* that existing services and their applications shall be protected from HAPS operations, and no undue constraints shall be imposed on the future development of existing services by HAPS,

resolves

1 that, for the purpose of protecting the fixed service systems in territory of other administrations in the frequency band 38-39.5 GHz, the power flux-density level (pfd) per HAPS produced at the surface of the Earth in 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:

 −137 dB(W/(m² · MHz)) for 0° ≤ θ ≤ 13°

 −137 + 3.125 (θ −  dB(W/(m² · MHz)) for 13° < θ ≤ 25°

 −99.5 + 0.5 (θ −  dB(W/(m² · MHz)) for 25° < θ ≤ 50°

 −87 dB(W/(m² · MHz)) for 50° < θ ≤ 90°

where θ is the angles of arrival of the incident wave above the horizontal plane, in degrees;

2 that, with regard to the protection of fixed service stations with pointing elevation beyond 15°, an administration believing that unacceptable interference may still be caused shall, within four months of the date of publication of the relevant BR IFIC, provide its comments with relevant justification to the notifying administration;

3 that, for the purpose of protecting the mobile service systems in territory of other administrations in the frequency band 38-39.5 GHz, the power flux-density level (pfd) per HAPS produced at the surface of the Earth in 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:

 −107.8                         dB(W/(m² · MHz)) for        0 < θ ≤ 4°

 −107.8 + 1.5 (θ − 4)    dB(W/(m² · MHz))  for        4° <  θ ≤ 10°

 −98.8                        dB(W/(m² · MHz)) for   10° <  θ ≤ 90°

where θ is the angles of arrival of the incident wave above the horizontal plane, in degrees.

The limits above do take into account 3 dB aggregate loss due to polarization mismatch and body loss was not taken into account;

4 that, for the purpose of protecting FSS GSO Earth station in the fixed-satellite service (space‑to-Earth) in the territory of other administrations, the power flux-density in the territory of other neighbouring administrations shall not exceed the following values, unless the explicit agreement of the affected administration is provided at the time of notification of HAPS:

 −169.9 + 1954 α² dB(W/(m² · MHz)) for 0 ≤ α < 0.136°

 −133.9 dB(W/(m² · MHz)) for 0.136° ≤ α < 1°

 −133.9 + 25 log α dB(W/(m² · MHz)) for 1° ≤ α < 47.9°

 −91.9 dB(W/(m² · MHz)) for 47.9° ≤ α ≤ 180°

where α is the minimum angle between the line to the HAPS (taking into account the HAPS location tolerance) and the lines to the GSO arc in degrees at any point of the territory of other administrations.

To calculate the pfd produced by a HAPS platform, the following equation shall be used:

 

where:

 *d*: distance between the HAPS and the GSO FSS earth station (m);

 *Attgaz*: attenuation due to atmospheric gases on the HAPS to GSO FSS earth station path in dB (Rec ITU-R P.676);

 *e.i.r.p*: maximum HAPS e.i.r.p. spectral density in the direction of the GSO FSS earth station in dB(W/MHz);

5 that, for the purpose of protecting FSS non-GSO systems in the fixed satellite service (space-to-Earth) in the territory of other administrations from HAPS interference , Administrations implementing HAPS shall seek explicit agreement with any other Administration when the distance between the HAPS nadir point and any point of such other administration’s border is less than the distance calculated by the following formula, where the minimum earth station elevation angle is 10 degrees. This does not preclude lower elevation angles to be used for the operation of earth stations. This distance can be decreased by explicit agreement of affected administrations on a case by case basis;

where:

 *R* is the Earth radius (6371 km)

 θ is the minimum elevation angle at the non-GSO FSS earth station (10°)

 *h* is the HAPS altitude (km)

6 that, in making assignments to HAPS systems (HAPS ground stations and HAPS) in the fixed service in the frequency band 38-39.5 GHz, administrations shall protect the space research service (SRS) (space-to-Earth) in the frequency band 37-38 GHz from harmful interference by unwanted emissions, taking into account the space research service (space-to-Earth) protection level of −217 dB(W/Hz) at the input of the SRS receiver with 0.001% exceedance due to atmospheric and precipitation effects as referred in the relevant ITU-R Recommendations;

7 that for the purpose of protecting mobile service systems operating in the frequency band 38-39.5 GHz in neighbouring administrations, coordination of a transmitting HAPS ground station is required when the power flux-density in dB(W/m²/MHz) at the border of a neighbouring administration exceeds a pfd limit of −110.8 dB(W/m²/MHz) and the pfd values shall be verified considering a percentage of time of 1% in the relevant propagation model (recommendation ITU-R P.452) and a mobile station antenna height of 20 m;

8 that for the purpose of protecting FSS GSO and NGSO earth station systems in the fixed-satellite service (space to-Earth) in neighbouring administrations, coordination of a transmitting HAPS ground station is required when the power flux-density in dB(W/m²/MHz) at the border of a neighboring administration exceeds a pfd limit of −111.3 dB(W/m²/MHz) for NGSO operations and −108.9 dB(W/m²/MHz) for GSO operations and the pfd values shall be verified considering a percentage of time of 20% in the relevant propagation model (Recommendation ITU-R P.452) and an FSS Earth station antenna height of 10 m;

9 that administrations planning to implement a HAPS system in the frequency band 38-39.5 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,

*invites the ITU-R*

to develop a Recommendation to provide technical guidance to facilitate the implementation of HAPS operations while ensuring the protection of non-GSO FSS earth stations.

Alternative 3 (Worldwide identification ground to HAPS)

ARTICLE 5

Frequency allocations

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

MOD WG4B/406/5#50573

34.2-40 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 38-39.5 FIXED ADD 5.G114 FIXED-SATELLITE (space-to-Earth) MOBILE Earth exploration-satellite (space-to-Earth) 5.547 |

ADD WG4B/406/6#50574

5.G114 The allocation to the fixed service in the band 38-39.5 GHz is identified for worldwide use by high-altitude platform stations (HAPS). Such use of the fixed-service allocation by HAPS is limited to the ground-to-HAPS direction. This identification does not preclude the use of this frequency band by other fixed service applications or by other services to which this band is allocated on a co-primary basis and does not establish priority in the Radio Regulations. See Resolution **[TBD] (WRC‑19)**.     (WRC‑19)

ADD WG4B/406/7#72623

draFt new RESOLUTION [TBD] (WRC‑19)

Use of the band 38-39.5 GHz by high altitude platform
stations in the fixed service

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

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 ITU-R to study additional spectrum needs for fixed HAPS links to provide broadband connectivity and to facilitate the use of HAPS linkson 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 Report ITU-R F.2439 contains updated deployment and technical characteristics of broadband HAPS systems;

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

*f)* that ITU‑R has conducted studies dealing with compatibility between systems using HAPS and existing services in the 38-39.5 GHz frequency band leading to Report ITU‑R F.2475;

*g)* 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,

considering further

that current technologies, such as high-altitude platform stations (HAPS), can be used to deliver broadband applications for broadband connectivity and disaster recovery communications with minimal ground network infrastructure,

resolves

1 that, in making assignments to HAPS ground stations in the fixed service in the frequency band 38-39.5 GHz, administrations shall protect the space research service (SRS) (space-to-Earth) in the frequency band 37-38 GHz from harmful interference by unwanted emissions, taking into account the space research service (space-to-Earth) protection level of −217 dB(W/Hz) at the input of the SRS receiver with 0.001% exceedance due to atmospheric and precipitation effects as referred in the relevant ITU-R Recommendations;

2 that for the purpose of protecting mobile service systems operating in the frequency band 38-39.5 GHz in neighbouring administrations, coordination of a transmitting HAPS ground station is required when the power flux-density in dB(W/m²/MHz) at the border of a neighbouring administration exceeds a pfd limit of −110.8 dB(W/m²/MHz) and the pfd values shall be verified considering a percentage of time of 1% in the relevant propagation model (recommendation ITU-R P.452) and a mobile station antenna height of 20 m;

3 that for the purpose of protecting FSS GSO and NGSO earth station systems in the fixed-satellite service (space to-Earth) in neighbouring administrations, coordination of a transmitting HAPS ground station is required when the power flux-density in dB(W/m²/MHz) at the border of a neighboring administration exceeds a pfd limit of −111.3 dB(W/m²/MHz) for NGSO operations and −108.9 dB(W/m²/MHz) for GSO operations and the pfd values shall be verified considering a percentage of time of 20% in the relevant propagation model (Recommendation ITU-R P.452) and an FSS Earth station antenna height of 10 m;

4 that administrations planning to implement a HAPS system in the frequency band 38-39.5 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.

Alternative 4 ([Regional] identification ground to HAPS)

MOD WG4B/406/10#72841

34.2-40 GHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 38-39.5 FIXED ADD 5.G114 FIXED-SATELLITE (space-to-Earth) MOBILE Earth exploration-satellite (space-to-Earth) 5.547 |

ADD WG4B/406/11#50574

5.G114 In Region 3 [and …], the allocation to the fixed service in the band 38-39.5 GHz may also be used by administrations wishing to implement high-altitude platform stations (HAPS), limited to operation in the ground-to-HAPS direction. Such use of the fixed-service allocation by HAPS is limited to the ground-to-HAPS direction and 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. [See Resolution **[TBD] (WRC‑19)** .     (WRC‑19)

ADD WG4B/406/11#50574

draFt new RESOLUTION [TBD] (WRC‑19)

Use of the band 38-39.5 GHz by high altitude platform
stations in the fixed service

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

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 ITU-R to study additional spectrum needs for fixed HAPS links to provide broadband connectivity and to facilitate the use of HAPS linkson 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 Report ITU-R F.2439 contains updated deployment and technical characteristics of broadband HAPS systems;

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

*f)* that ITU‑R has conducted studies dealing with compatibility between systems using HAPS and existing services in the 38-39.5 GHz frequency band leading to Report ITU‑R F.2475;

*g)* 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,

considering further

that current technologies, such as high-altitude platform stations (HAPS), can be used to deliver broadband applications for broadband connectivity and disaster recovery communications with minimal ground network infrastructure,

resolves

1 that, in making assignments to HAPS ground stations in the fixed service in the frequency band 38-39.5 GHz, administrations shall protect the space research service (SRS) (space-to-Earth) in the frequency band 37-38 GHz from harmful interference by unwanted emissions, taking into account the space research service (space-to-Earth) protection level of −217 dB(W/Hz) at the input of the SRS receiver with 0.001% exceedance due to atmospheric and precipitation effects as referred in the relevant ITU-R Recommendations;

2 that for the purpose of protecting mobile service systems operating in the frequency band 38-39.5 GHz in neighbouring administrations, coordination of a transmitting HAPS ground station is required when the power flux-density in dB(W/m²/MHz) at the border of a neighbouring administration exceeds a pfd limit of −110.8 dB(W/m²/MHz) and the pfd values shall be verified considering a percentage of time of 1% in the relevant propagation model (recommendation ITU-R P.452) and a mobile station antenna height of 20 m;

3 that for the purpose of protecting FSS GSO and NGSO earth station systems in the fixed-satellite service (space to-Earth) in neighbouring administrations, coordination of a transmitting HAPS ground station is required when the power flux-density in dB(W/m²/MHz) at the border of a neighboring administration exceeds a pfd limit of −111.3 dB(W/m²/MHz) for NGSO operations and −108.9 dB(W/m²/MHz) for GSO operations and the pfd values shall be verified considering a percentage of time of 20% in the relevant propagation model (Recommendation ITU-R P.452) and an FSS Earth station antenna height of 10 m;

4 that administrations planning to implement a HAPS system in the frequency band 38-39.5 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.

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