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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 toDocument 68-E** |
|  | **6 October 2019** |
|  | **Original: Arabic** |
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| Qatar (State of) |
| 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;

Resolution **160 (WRC‑15)** – *Facilitating access to broadband applications delivered by high‑altitude platform stations*

Introduction

WRC-19 agenda item 1.14 considers additional spectrum needs for gateway and fixed terminal links for HAPS to provide broadband connectivity in the fixed-service (FS) pursuant to Resolution **160 (WRC‑15)**.

The results of studies estimate the total spectrum needs for HAPS systems to be:

– in the range of 396 (for lower user density setting) to 2 969 MHz (for higher user density setting) for the ground-to-HAPS links;

– in the range of 324 (for lower user density setting) to 1 505 MHz (for higher user density setting) for the HAPS-to-ground links.

The sharing studies conducted by ITU-R consider the following frequency ranges:

– 6 440-6 520 MHz;

– 21.4-22 GHz (Region 2 only);

– 24.25-27.5 GHz (Region 2 only);

– 27.9-28.2 GHz and 31-31.3 GHz;

– 38-39.5 GHz;

– 47.2-47.5 GHz and 47.9-48.2 GHz.

Section 1/1.14/4 of the CPM Report includes the following generic methods to satisfy the agenda item, and describes the way the methods are applied to the above-mentioned frequency bands, as appropriate:

– Method A – No change.

– Method B – Identification of bands for HAPS, in accordance with Resolution **160 (WRC-15)** with options:

• Method B1 – Revision of the regulatory provisions for HAPS in the fixed service (FS) with a primary status in bands already identified for HAPS.

• Method B2 – Add new identification(s) for HAPS in bands already allocated to the FS with a primary status.

• Method B3 – Add a primary allocation to the FS and a new identification for HAPS in the band 24.25-25.25 GHz (Region 2) not already allocated to the FS.

– Method C – Suppress the existing HAPS identification, pursuant to *resolves* 3 of Resolution **160 (WRC-15)**.

Proposals

The Qatari Administration proposes the methods indicated with each identified frequency band below in order to satisfy this item on the agenda of the Conference.

Frequency band 6 440-6 520 MHz

Method 1B1

ARTICLE 5

Frequency allocations

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

MOD QAT/68A14/1#49730

5 570-6 700 MHz

|  |
| --- |
| Allocation to services |
| Region 1 | Region 2 | Region 3 |
| 5 925-6 700 FIXED 5.457 ADD 5.A114 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C 5.149 5.440 5.458 |

Method 1B1, Option 2

ADD QAT/68A14/2#49733

5.A114 The allocation to the fixed service in the 6 440-6 520 MHz 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 is limited to the HAPS-to-ground 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 services shall not be constrained by HAPS.     (WRC‑19)

Frequency band 27.9-28.2 GHz

Method 6B1

ARTICLE 5

Frequency allocations

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

MOD QAT/68A14/3#49773

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 |

*NOTE: Under this method, if the band 27.9-28.2 GHz is modified, there would need to be consequential modifications to Resolution* ***145 (Rev.WRC-12)*** *in implementation of Method B1.*

Method 6B1, Option 2

ADD QAT/68A14/4#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 **[QAT/E114-28+31B1-O2] (WRC‑19)**.     (WRC‑19)

SUP QAT/68A14/5#49768

5.537A

Example Resolution for Method 6B1 – Option 2

ADD QAT/68A14/6#49772

DRAFT NEW RESOLUTION [QAT/E114-28+31B1-O2] (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 WRC‑15 decided to study additional spectrum needs for fixed HAPS links to provide broadband connectivity;

*b)* that HAPS can provide broadband connectivity with minimal ground network infrastructure,

resolves

Option 1 (Protection of mobile service):

1 that for the purpose of protecting mobile service systems in territory of other administrations in the band 27.9-28.2 GHz, the power flux-density level per HAPS produced at the surface of the Earth in territory of other administrations shall not exceed the following pfd limits, unless the explicit agreement of the affected administrations is provided at the time of notification of HAPS:

 −122.7 dB(W/(m² · MHz)) for 0° ≤ θ < 2°

 −122.7 + 2 (θ − 2) dB(W/(m² · MHz)) for 2° ≤ θ < 2.3°

 −122.6 + 1.5 (θ − 2) dB(W/(m² · MHz)) for 2.3° ≤ θ < 7.9°

 −113.9 dB(W/(m² · MHz)) for 7.9° ≤ θ ≤ 90°

where θis the elevation angle in degrees (angles of arrival above the horizontal plane);

Option 2 (Protection of mobile service):

1 that for the purpose of protecting the mobile service systems in the band 27.9-28.2 GHz, 63.5 km a protection distance between HAPS nadir and MS stations is required;

2 that for the purpose of protecting the fixed-satellite service (Earth-to-space) in the band 27.9-28.2 GHz, the maximum e.i.r.p. density per HAPS downlink shall be less than −8 dB(W/MHz) in any direction for off-nadir angle higher than 85°;

3 that for the purpose of protecting fixed-service systems in territory of other administrations in the band 27.9-28.2 GHz, the power flux-density level per HAPS produced 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 from the affected administration is provided at the time of notification of HAPS:

 2 θ − 135 dB(W/(m² · MHz)) for 0° ≤ θ < 10°

 0.66 θ − 119.6 dB(W/(m² · MHz)) for 10° ≤ θ < 45°

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

where θis the elevation angle in degrees (angle of arrival above the horizontal plane). This pfd mask already takes into account the impact of attenuation due to atmospheric gases;

4 that for the purpose of protecting fixed service systems in territory of other administrations in the band 31-31.3 GHz, the power flux-density level per HAPS produced 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:

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

 3.1 θ − 167 dB(W/(m² · MHz)) for 10° ≤ θ < 20°

 0.375 θ − 112.5 dB(W/(m² · MHz)) for 20° ≤ θ < 60°

 −90 dB(W/(m² · MHz)) for 60° ≤ θ ≤ 90°

where θ is the elevation angle in degrees (angle of arrival above the horizontal plane). This pfd mask already takes into account the impact of attenuation due to atmospheric gases;

5 that in order to ensure the protection of the Earth exploration-satellite service (passive), the level of unwanted emission e.i.r.p. density per HAPS transmitter operating in the 31-31.3 GHz band shall be limited into the 31.3-31.8 GHz band to:

 −θ−13.1 dB(W/200 MHz) −4.53° ≤ θ < 22°

 −35.1 dB(W/200 MHz) 22° ≤ θ < 90°

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

6 that in order to ensure the protection of the radio astronomy service the pfd produced by unwanted emissions from HAPS downlink transmissions shall not exceed −171 dB(W/(m² · 500 MHz)) for continuum observations in the band 31.3-31.8 GHz at an RAS station location at a height of 50 m; and that this pfd value shall be verified considering a percentage of time of 2% in the relevant propagation model;

7 that *resolves* 6 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 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* 8 applies. Radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

Frequency band 31-31.3 GHz

Method 7B1

ARTICLE 5

Frequency allocations

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

MOD QAT/68A14/7#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 |

*NOTE: Under this method, if the band 31-31.3 GHz is modified, there would need to be consequential modifications to Resolution* ***145 (Rev.WRC-12)*** *in implementation of Method B1.*

Method 7B1, Option 1B

ADD QAT/68A14/8#49781

5.F114The allocation to the fixed service in the band 31-31.3 GHz is identified for worldwide use by high-altitude platform stations (HAPS) in the ground-to-HAPS direction. Such use of the fixed-service allocation by HAPS is subject to the provisions of Resolution **[QAT/E114‑28+31B1-O1] (WRC‑19)**.     (WRC‑19)

SUP QAT/68A14/9#49784

5.543A

Example Resolution for Method 7B1 – Option 1

ADD QAT/68A14/10#49771

DRAFT NEW RESOLUTION [QAT/E114-28+31B1-O1] (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 elevation angle in degrees (angles of arrival above the horizontal plane);

Option 1:

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));

Option 2:

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 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 elevation angle in degrees (angle of arrival above the horizontal plane);

Option 1:

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));

Option 2:

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;

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 for the purpose of protecting the fixed-service systems in territory of other administrations in the band 31-31.3 GHz, the power flux-density level per HAPS at the surface of the Earth in 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 the HAPS:

 0.875 θ − 143 dB(W/(m² · MHz)) for 0° ≤ θ < 8°

 2.58 θ − 156.6 dB(W/(m² · MHz)) for 8° ≤ θ < 20°

 0.375 θ − 112.5 dB(W/(m² · MHz)) for 20° ≤ θ < 60°

 −90 dB(W/(m² · MHz)) for 60° ≤ θ ≤ 90°

where θis the elevation angle in degrees (angle of arrival above the horizontal plane);

Option 1:

In order to compensate for additional propagation impairments in the boresight 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*: 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));

Option 2:

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;

5 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;

6 that in order to ensure the protection of EESS (passive) services the e.i.r.p. density in the band 31.3-31.8 GHz per HAPS, operating in the band 31-31.3 GHz, shall not exceed:

 −θ − 13.1 dB(W/200 MHz) −4.53° ≤ θ < 22°

 −35.1 dB(W/200 MHz) 22° ≤ θ < 90°

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

7 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%;

8 that in order to ensure the protection of the radio astronomy service the power flux-density produced by unwanted emissions from HAPS downlink transmissions shall not exceed −171 dB(W/(m2 · 500 MHz)) for continuum observations in the band 31.3-31.8 GHz at an RAS station location at a height of 50 m. This limit relates to the power flux-density which would be obtained using a time percentage of 2% in the relevant propagation model;

Option 1:

to verify the compliance the following formula shall be used:

 

where:

 *e.i.r.p.nominal clear sky:* nominal unwanted emission e.i.r.p. density towards the RAS station at which the HAPS station operates under clear-sky conditions in dB(W/500 MHz) in the RAS band;

 *Az*: azimuth from the HAPS toward the RAS station;

 θ: elevation angle at the HAPS towards the RAS station;

 *Att*618*p=*2%: attenuation from Recommendation ITU‑R P.618 corresponding to *p* = 2% of the time at the radio astronomy location;

 *d*: separation distance in m between the HAPS and the RAS station;

 *pfd*(θ):power flux-density at the Earth’s surface per HAPS station in dB(W/m2 · 500 MHz);

 *GasAtt*(θ): gaseous attenuation for elevation angle of θ (Rec. ITU‑R SF.1395‑0);

Option 2:

*NOTE: No formula necessary.*

9 that that *resolves* 7 and 8 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 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 and 8 apply. Radio astronomy stations notified after this date may seek an agreement with administrations that have authorized HAPS;

10 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.

Frequency band 38-39.5 GHz

Method 8B2, Option 2

ADD QAT/68A14/11#49793

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). 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 **[QAT/G114-38B2-O2] (WRC‑19)**.     (WRC‑19)

Example Resolution for Method 8B2 – Option 2

ADD QAT/68A14/12#49795

DRAFT NEW RESOLUTION [QAT/G114-38B2-O2] (WRC‑19)

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

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

considering

*a)* that WRC‑15 decided to conduct studies to address the 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 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,

resolves

1 that in making assignments to HAPS ground stations in the fixed service in the bands 38-39.5 GHz, administrations shall protect the space research service (space-to-Earth) in the bands 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 terminals of the SRS receiver with 0.001% exceedance due to atmospheric and precipitation effects;

2 that for the purpose of protecting fixed-service systems in territory of other administrations in the band 38-39.5 GHz, the power flux-density limit per HAPS produced at the surface of the Earth in territory of other administrations shall not exceed the following limits, under clear-sky conditions, without the explicit agreement of the affected administration:

 −137 dB(W/(m² · MHz)) for 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 elevation angle in degrees (angle of arrival above the horizontal plane). This pfd mask already takes into account the impact of attenuation due to atmospheric gases;

3 that for the purpose of protecting mobile-service systems in territory of other administrations in the band 38-39.5 GHz, the power flux-density level per HAPS ground station produced at the surface of the Earth, applied at the border of affected neighbouring administrations shall not exceed the following limits, under clear-sky conditions, without the explicit agreement of the affected administration:

 −110.8 dB(W/(m² · MHz)) for θ ≤ 4°

 −110.8 + 1.5 (θ − 4) dB(W/(m² · MHz)) for 4° < θ ≤ 11.5°

 −101.8 dB(W/(m² · MHz)) for 11.5° < θ ≤ 90°

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

4 that for the purpose of protecting FSS GSO and non-GSO earth station systems in the fixed satellite service (space-to-Earth) in the territory of other administrations, coordination of a transmitting HAPS ground station is required when the power-flux density in dB(W/(m² · MHz)) at the border of the territory of other administration exceeds pfd limit of −111.1 dB(W/(m² · MHz)) for non-GSO 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,

instructs the Director of the Radiocommunication Bureau

to take all necessary measures to implement this Resolution.

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