**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.*

**INTRODUCTION**

Article 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 delivery. Resolution **160** resolves to invite ITU-R to study additional spectrum needs of HAPS, examining the suitability of existing HAPS identifications and conducting sharing and compatibility studies for additional identifications 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 in Region 2.

**BACKGROUND**

The technological innovations and the growing urgency to expand the availability of broadband has led to a review of the current regulatory environment for delivery platforms such as HAPS. Stations operating in the stratosphere are high enough to provide service to a large area. Recent test deployments of stations delivering broadband from approximately 20 km above ground have demonstrated their maturity for the potential of such stations for providing connectivity to underserved communities with minimal ground-level infrastructure and maintenance.

Agenda item 1.14 incorporates the principle that more options for broadband delivery are better, especially for countries with less-developed infrastructures. As such, agenda item 1.14 has gained adherents because HAPS platforms can drive broadband rollout: not by supplying a service to compete with existing providers, but by providing an additional platform that existing service providers can use to augment their capacity. In this way, HAPS offers a boost, or overlay, to existing broadband providers using innovative and easily deployable backhaul platforms positioned in the upper atmosphere. WRC-15 adopted Resolution **160** to study how to facilitate access to global broadband applications delivered by HAPS in the fixed service.

Currently there are three 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).

However, spectrum needs of next-generation HAPS cannot be accommodated within these identifications due to either geographical restrictions or technical limitations which impairs their operation. The global identification for HAPS links (which is in the 47.2-47.5 GHz and 47.9-48.2 GHz band fixed-service allocations) suffers from the effects of rain fade attenuation that severely limit service provision over high-precipitation geographies. The remaining two 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 very limited amount of countries, none of which is within ITU Region 2.

**BROADBAND HAPS**

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:** A single plane will 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 solar 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 will 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:** It will be possible to deploy HAPS services 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 where it is impossible to deploy terrestrial infrastructure: 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.

Spectrum harmonization and utilization is facilitated by common worldwide identifications. International regulatory flexibility enables 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.

**SHARING STUDIES**

ITU-R Working Party 5C (WP 5C) is the group responsible for Agenda Item 1.14. WP 5C has, in turn, established a specific HAPS working group to examine the compatibility between HAPS and services operating or planning to operate in the bands under study as per Resolution **160** (WRC 15).

*Further resolves 1* of Resolution **160** **(WRC-15)** asks that ITU-R studies on AI 1.14 “include sharing and compatibility studies to ensure protection of existing services allocated in the frequency ranges identified and, as appropriate, adjacent band studies, taking into account studies already performed in ITU-R”. WP 5C has identified a number of sharing and compatibility studies to be conducted, including adjacent band studies. The draft studies are currently located in the Working Party 5C Chairman’s Report.

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

**PROPOSAL**

The actions described above are intended to facilitate the timely introduction of broadband connectivity via HAPS operating in the Fixed service. This proposal will modify the Radio Regulations to accommodate broadband HAPS by revising some of the existing identifications and /or identifying new frequency allocations as appropriate. It will determine the reasons for making these identifications and demonstrate the ways in which HAPS can operate in these frequencies without disrupting any incumbent services. It will also propose a new allocation in the 24.25-27.5 GHz frequency range for Fixed Service.

**ATTACHMENT**

**U.S. PROPOSAL**

**For the frequency bands 27.9 - 28.2 GHz and 31.0 – 31.3 GHz**

**For the frequency band 27.9 - 28.2 GHz**

RR **5.537A** is revised to read:

~~In Bhutan, Cameroon, Korea (Rep. of), the Russian Federation, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Kazakhstan, Malaysia, Maldives, Mongolia, Myanmar, Uzbekistan, Pakistan, the Philippines, Kyrgyzstan, the Dem. People’s Rep. of Korea, Sudan, Sri Lanka, Thailand and Viet Nam,~~ The allocation to the fixed service in the band 27.9-28.2 GHz may also be used by high altitude platform stations (HAPS) ~~within the territory of these countries~~ globally on a co-primary basis. Such use of 300 MHz of the fixed-service allocation by HAPS ~~in the above countries~~ is ~~further~~ limited to operation in the HAPS-to-ground direction[See Resolution **145 (Rev.WRC-19)]**. (WRC-19)

**For the frequency band 31.0 – 31.3 GHz**

RR **5.543A** is revised to read:

~~In Bhutan, Cameroon, Korea (Rep. of), the Russian Federation, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Kazakhstan, Malaysia, Maldives, Mongolia, Myanmar, Uzbekistan, Pakistan, the Philippines, Kyrgyzstan, the Dem. People’s Rep. of Korea, Sudan, Sri Lanka, Thailand and Viet Nam,~~ The allocation to the fixed service in the band 31-31.3 GHz may also be used by systems using high altitude platform stations (HAPS) in the ground-to-HAPS or HAPS-to-ground direction and globally on a co-primary basis. Systems using HAPS in the band 31-31.3 GHz 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 as given in Recommendation ITU-R RA.769. In order to ensure the protection of satellite passive services, the level of unwanted power density into a 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 the effective impact on the passive satellite does not exceed the impact under clear-sky conditions. See Resolution **145 (Rev.WRC-19)**. (WRC-19)

RESOLUTION 145 (rev.WRC‑19)

**…**

**For the frequency band 47.2- 47.5 GHz and 47.9- 48.2 GHz**

RR **5.552A** is revised to read:

The allocation to the fixed service in the bands 47.2-47.5 GHz and 47.9-48.2 GHz is designated for use by high altitude platform stations in the ground -to -HAPS direction. The use of the bands 47.2-47.5 GHz and 47.9-48.2 GHz is subject to the provisions of Resolution **122 (Rev.WRC-19)**. (WRC-19)

RESOLUTION 122 (rev.WRC‑19)

**…**

**For the frequency band 21.4-22 GHz**

A HAPS identification is added to Region 2 under new RR 5.xxx. The use of the bands 21.4-22 GHz is subject to the provisions of Resolution **XXX (WRC-19)**.

RR 5.xxx The allocation to the fixed service in the bands 21.4 - 22 GHz is designated for use by high altitude platform stations. The use of the bands 21.4 -22 GHz is subject to the provisions of Resolution **XXX (WRC-19)**.

RESOLUTION XXX (WRC‑19)

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

**For the frequency band 24.25-27.5 GHz**

A new allocation to Article 5 is added in Region 2 for Fixed Service for the 24.25-25.25 GHz band, followed by a new identification for HAPS in the Fixed service allocation for Region 2 under new RR 5.yyy. The use of the bands 24.25-27.5 GHz is subject to the provisions of Resolution **YYY (WRC-19)**.

RR 5.yyy The allocations to the fixed service in the bands 24.25-27.5 GHz are designated for use by high altitude platform stations in Region 2. The use of the bands 24.25-27.5 GHz is subject to the provisions of Resolution **YYY (WRC-19)**.

RESOLUTION YYY (WRC‑19)

**Use of the bands 24.25-27.5 GHz by fixed links for high altitude platform stations in the fixed service**

**For the frequency band 38.0 – 39.5 GHz**

A new identification for HAPS in the global Fixed service allocation is added for fixed links under new RR 5.zzz. The use of the bands 38.0 – 39.5 GHz is subject to the provisions of Resolution **ZZZ (WRC-19)**.

RR. zzz The allocation to the fixed service in the 38.0 – 39.5 GHz band is designated for use by high altitude platform stations. The use of the bands 38.0 – 39.5 GHz is subject to the provisions of Resolution **ZZZ (WRC-19)**.

RESOLUTION ZZZ (WRC‑19)

**Use of the bands 38.0 – 39.5 GHz by fixed links for high altitude platform stations in the fixed service**

**…**

**Regulatory and procedural considerations**

*[Example(s) of regulatory text relating to the Method(s) to satisfy the agenda item.]*

ARTICLE 5

Frequency allocations

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

24.75-29.9 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| **…** | | |
| **27.5-28.5** | FIXED 5.537A (REV. WRC-19)  FIXED-SATELLITE (Earth-to- space) 5.484A 5.516B 5.539  MOBILE  5.538 5.540 | |
| **…** | | |

**Reasons:** The proposal allows the 27.9-28.2 GHz band, currently paired with 31.0-31.3 GHz in a HAPS identification, but identified to HAPS in only several countries in Regions 1 and 3, to be accessible for HAPS-CPE fixed links on a global basis.

29.9-34.2 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| **…** | | |
| **31-31.3** | FIXED 5.338A 5.543A (REV. WRC-19)  MOBILE  Standard frequency and time signal-satellite (space-to-Earth)  Space research 5.544 5.545  5.149 | |
| **…** | | |

**Reasons:** The proposal allows the 31.0-31.3 GHz band, currently paired with 27.9 – 28.2 GHz in an existing identification but identified to HAPS in only several countries in Regions 1 and 3, to be accessible for HAPS-ground links on a global basis.

40-47.5 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| **…** | | |
| **47.2-47.5** | FIXED 5.552A (REV. WRC-19)  FIXED-SATELLITE (Earth-to-space) 5.552  MOBILE  5.552A | |

**Reasons:** The proposal allows the band to be accessible to HAPS for ground-to-HAPS fixed links under appropriate technical conditions that facilitate broadband delivery.

47.5-51.4 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| **…** | | |
| **47.9-48.2** | FIXED 5.552A (REV. WRC-19)  FIXED-SATELLITE (Earth-to-space) 5.552  MOBILE | |
| **…** | | |

**Reasons:** The proposal allows the band to be accessible to HAPS for ground-to-HAPS fixed links under appropriate technical conditions that facilitate broadband delivery.

18.4-22 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Allocation to services | | | |
| Region 1 | Region 2 | | Region 3 |
| **…** | | | |
| **21.4-22 GHz**  FIXED  MOBILE  BROADCASTING-SATELLITE  5.208B  5.530A 5.530B  5.530C 5.530D | | **21.4-22**  FIXED ADD RR 5.xxx  MOBILE  5.530A 5.530C | **21.4-22**  FIXED  MOBILE  BROADCASTING-SATELLITE  5.208B  5.530A 5.530B  5.530C 5.530D 5.531 |

**Reasons:** The proposal allows the band to be accessible to HAPS for HAPS-ground fixed links under technical conditions that facilitate broadband delivery.

24.25 – 25.25 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Allocation to services | | | |
| Region 1 | Region 2 | | Region 3 |
| **…** | | | |
| **24.25-24.45**  FIXED | | **24.25-24.45**  RADIONAVIGATION  ADD FIXED  ADD RR 5.yyy | **24.25-24.45**  RADIONAVIGATION  FIXED ADD RR 5.xxx  MOBILE |
| **24.45-24.65**  FIXED  INTER-SATELLITE | | **24.45-24.65**  INTER-SATELLITE  RADIONAVIGATION  ADD FIXED, RR 5.yyy | **24.45-24.65**  FIXED  INTER-SATELLITE  MOBILE  RADIONAVIGATION  5.533 |
| **24.65-24.75**  FIXED  FIXED-SATELLITE  (Earth-to-space) 5.532B  INTER-SATELLITE | | **24.65-24.75**  INTER-SATELLITE  RADIOLOCATION-SATELLITE (Earth-to-space)  ADD FIXED, RR 5.yyy | **24.65-24.75**  FIXED  FIXED-SATELLITE (Earth-to-space) 5.532B  INTER-SATELLITE  MOBILE  5.533 |
| **24.75-25.25**  FIXED  FIXED-SATELLITE  (Earth-to-space) 5.532B | | **24.75-25.25**  FIXED-SATELLITE  (Earth-to-space) 5.535  ADD FIXED, RR 5.yyy | **24.75-25.25**  FIXED  FIXED-SATELLITE  (Earth-to-space) 5.535  MOBILE |

**Reasons:** The proposal allows the band to be accessible to HAPS for ground-to-HAPS and HAPS-to-ground fixed links under technical conditions that facilitate broadband delivery.

25.25 – 27.5 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| **…** | | |
| **25.25-25.5**  FIXED ADD RR 5.yyy  INTER-SATELLITE 5.536  MOBILE  Standard frequency and time signal-satellite (Earth-to-space) | | |
| **25.5-27.0**  EARTH EXPLORATION SATELLITE (space-to-Earth) 5.536B  FIXED ADD RR 5.yyy  INTER-SATELLITE 5.536  MOBILE  SPACE RESEARCH (space-to-Earth) 5.536C  Standard frequency and time signal-satellite (Earth-to-space)  5.536A | | |
| **27-27.5**  FIXED  INTER-SATELLITE 5.536  MOBILE | **27-27.5**  FIXED ADD RR 5.yyy  FIXED-SATELLITE (Earth-to-space)  INTER-SATELLITE 5.536 5.537  MOBILE | |

**Reasons:** The proposal allows the band to be accessible to HAPS for ground-to-HAPS and HAPS-to-ground fixed links in Region 2 under technical conditions that facilitate broadband delivery.

Method for 1.14/6.9

37.5 – 39.5 GHz

|  |  |  |
| --- | --- | --- |
| Allocation to services | | |
| Region 1 | Region 2 | Region 3 |
| **…** | | |
| **38.0-39.5 GHz**  FIXED ADD RR 5.zzz  FIXED-SATELLITE (space-to-Earth)  MOBILE  Earth exploration-satellite (space-to-Earth)  5.547 | | |

**Reasons:** The proposal allows the band to be accessible to HAPS for ground-HAPS fixed links globally under technical conditions that facilitate broadband delivery.