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| Summary: | | |
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| Proposal: | | |
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DRAFT CEPT BRIEF ON 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

# ISSUE

Resolution 160 (WRC-15) resolves to invite ITU-R:

1. study additional spectrum needs for gateway and fixed terminal links for HAPS to provide broadband connectivity in the fixed service taking into account:

the existing identifications and deployments of HAPS systems;

the deployment scenarios envisioned for HAPS broadband systems and related requirements such as in remote areas;

the technical and operational characteristics of HAPS systems, including the evolution of HAPS through advances in technology and spectrally-efficient techniques, and their deployment;

1. study the suitability of using the existing identifications in recognizing c), on a global or regional level, taking into account the regulatory provisions, such as geographical and technical restrictions associated with existing HAPS identifications based on the study performed in resolves to invite ITU-R 1;
2. study appropriate modifications to the existing footnotes and associated resolutions in the identifications in recognizing c) in order to facilitate the use of HAPS links on a global or regional level, limited to the currently identified frequency bands and, where the use of an identification is not technically feasible for HAPS use, consider the possible removal of the unsuitable identification;
3. to study, in order to meet any spectrum needs which could not be satisfied under resolves to invite ITU-R 2 and 3, for the use of gateway and fixed terminal links for HAPS, the following frequency bands already allocated to the fixed service on a primary basis, not subject to Appendices 30, 30A, and 30B in any region:

on a global level: 38-39.5 GHz, and

on a regional level: in Region 2, 21.4-22 GHz and 24.25-27.5 GHz,

further resolves

1. that the studies referred to in resolves to invite ITU-R 3 and 4 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.
2. that modifications studied under resolves to invite ITU-R 3 shall not consider the use of HAPS links in the frequency bands subject to Appendix 30B;
3. to develop ITU-R Recommendations and Reports, as appropriate, on the basis of the studies called for in resolves to invite ITU-R 1, 2, 3, and 4 above,

# Preliminary CEPT position

* CEPT supports consideration of this Agenda item in accordance with Resolution 160 (WRC-15) while taking into account in particular:

the developments and requirements in HAPS in the fixed service and the associated spectrum sharing aspects

the need to ensure there is protection in place in order not to limit the possibility to use and develop existing services including other applications of the fixed service in the frequency bands identified and, as appropriate, in the adjacent bands.

* CEPT has initiated studies on spectrum needs for broadband connectivity HAPS applications.
* CEPT is of the view that any consideration of the frequency band 24.25-27.5 GHz under this Agenda item should not limit the possibility to identify the band for IMT on a global level under Agenda item 1.13.

# Background

As noted in the outcome of meeting of CPM19-1 (ITU administrative circular [CA/226](https://www.itu.int/dms_pub/itu-r/md/00/ca/cir/R00-CA-CIR-0226!!MSW-E.docx)), the studies under WRC-19 Agenda Item 1.14 should also take into account that the band 38.0-39.5 GHz is also being studied under WRC-19 Agenda Items 1.6 and 1.13 and the band 24.25-27.5 GHz is under study under Agenda item 1.13.

Recent improvements in aerial platforms, lithium batteries, lightweight composite materials, solar technology, and spectral efficiency are creating the potential for realizable, large-scale HAPS systems. These technological innovations and the growing urgency to expand the availability of broadband has led to a call for review of the current regulatory environment for HAPS. As the ITU-R has recognized, stations operating in the stratosphere are high enough to provide services to a large footprint but also low enough to provide low latency services and coverage in more densely populated areas.

Expanding broadband access (both coverage and capacity) is the foremost challenge for telecommunications policymakers throughout the world. Broadband has become the centre of our society and the key ticket to, and catalyst for, opportunity, education, health, growth, and prosperity. It is important to ensure all citizen are connected. With sufficient capacity, HAPS can provide broadband connectivity over a large geographical region with throughput also suitable for dense user coverage.

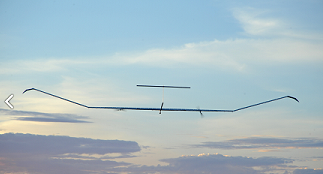
Recent test deployments of stations delivering broadband from approximately 20 km above ground have demonstrated the potential of such stations for providing connectivity to underserved communities with minimal ground-level infrastructure and maintenance. HAPS can therefore be effective tools, among others, to help close the digital divide in remote communities, particularly those with challenging terrain or climate.

HAPs can take several different forms – some examples of proposed HAPS based systems are given in section 3 below.

## High altitude platform Examples

### HAPs aircraft

The fixed wing High Altitude Platforms (HAPs) consists of a solar-electric powered autonomous aircraft. HAPs aircraft incorporate a rechargeable power system which uses solar-electric power to fly during the day and charge high capacity secondary batteries for discharge at night time. The HAPs aircraft are capable of continuous flight over multiple days and the current record for continuous flights stands at 14 days. HAPs aircrafts are capable of operation in the stratosphere above the weather and can reach altitudes in excess of 70,000ft (~21km).



### HAPs LTA

The Lighter-Than-Air (LTA) High Altitude Platforms (HAPS) consists in an autonomous Airship using buoyancy to provide lift and solar-electric power to maintain its position against stratospheric winds. A typical HAPS-LTA can provide day-and-night permanent mission that can last several months at an altitude between 60 000 feet (~18km) and 75 000 feet (~22km).



## BROADband HAPS applications

1. to be further reviewed at a future PT-A meeting

### Broadband connectivity HAPS applications

Amongst the envisaged applications of HAPS include broadband connectivity in particular for underserved/rural communities. This scenario is the most demanding in terms of spectrum bandwidth needs.

Based on 2014 statistics, 3.2 billion people worldwide use the Internet. This is a milestone, but it also means that only 43.4% of the world’s population has ever been connected to the Internet[[1]](#footnote-1). It is no surprise that the unconnected are disproportionately located in developing countries (82.2% of the population in the developed world is online compared to just 35.3% in emerging economies). Moreover, Internet adoption is slowing—the rate of growth declined for the fourth year in a row to just 6.9% in 2014 (down from 14.0% in 2010). At present rates of decelerating growth, the Internet will not reach 4 billion people until 2019.

The ITU’s Connect 2020 Agenda calls for 90% rural broadband coverage by 2020[[2]](#footnote-2). Given that by 2015 rural coverage was only 30% globally, and much lower in developing and the least developed countries, a large focus over the next five years has to be on rural deployment[[3]](#footnote-3). HAPS are a flexible platform that could one day be deployed rurally, utilizing a fleet of HAPS to backhaul data to an Internet point of presence where ground -based backhaul is not available.

Given recent innovation in antenna and other technologies, multi-gigabit broadband capacity might be achieved using HAPS. A provider using HAPS can architect its network to either optimize capacity or coverage. For instance, a fleet of HAPS may be deployed to either efficiently cover a broad area, or to provide more capacity to a medium population density area.

### Specific broadband HAPS applications

Some broadband HAPS communication usages foreseen are:

* Natural disaster relief missions, where communication for coordination and situation awareness across help and humanitarian aid organisations is needed.
* Fire detection, monitoring and firefighting missions to ensure communication between actors.
* Law enforcement with communication needs across local actors and regional headquarters.
* Exploration missions with communication needs between exploration teams and regional home base.
* Mobile network backhauling via HAPS to cover remote areas.

## broadband haps deployement scenario

### Direct connectivity to the end users

The service is provided to end users directly through HAPS.



Figure 1: Illustration of direct connectivity scenario

### Backhauling scenario

HAPS which are connected to internet gateways are providing backhaul to ground infrastructure.

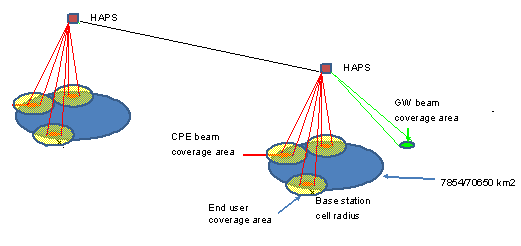


Figure 2: Illustration of backhauling scenario

## Broadband haps spectrum requirements

### Broadband connectivity HAPS spectrum requirements

Initial studies presented in CPG PTA show that the current HAPS identifications will not satisfy the throughput requirements expressed for both user and gateway links. Throughput requirement for a single HAPS is estimated to be 30 Gbit/s[[4]](#footnote-4) which leads to architectures which are not technically and economically viable (e.g. more than 33 gateways needed per HAPS). Those initial studies are based on assumptions that could be impacted by sharing analyses with incumbent services. Therefore, studies under Resolves 4 of Resolution 160 (WRC-15) would need to be performed.

### Specific broadband HAPS spectrum requirements

1. to be completed at a future PT-A meeting

## Technical and regulatory studies in Existing identified bands for haps

### 6 440-6 520 MHz (HAPS to ground) and 6 560-6 640 MHz (ground to HAPS)

#### Current Radio Regulation in the band 6 640-6 520 MHz and 6 560-6 640 MHz

For countries listed in footnote 5.457[[5]](#footnote-5), the allocation to the fixed service in the bands 6 440-6 520 MHz (HAPS-to-ground direction) and 6 560-6 640 MHz (ground-to-HAPS direction) is identified for high-altitude platform stations (HAPS). Such use is limited to gateway links within the territory of these countries, and in accordance with Resolution 150 (Rev.WRC-12), defining operating conditions in order to protect incumbent services in these bands, and shall not claim protection from existing services.

The use of HAPS gateway links in these bands requires explicit agreement with other administrations whose territories are located within 1 000 kilometres from the border of an administration intending to use the HAPS gateway links.

The frequency bands 6 440-6 520 MHz and 6 560-6 640 MHz are worldwide allocated on a primary status to the fixed, the mobile and the fixed satellite (Earth-to-space) services. In Region 2 (except a limited list of countries), the band 5 925-6 700 MHz may be used for aeronautical mobile telemetry for flight testing by aircraft stations. Such use shall be in accordance with Resolution 416 (WRC-07) and shall not cause harmful interference to, nor claim protection from, the fixed-satellite and fixed services.

In the band 6 425-7 075 MHz, passive microwave sensor measurements are carried out over the oceans. In the band 7 075-7 250 MHz, passive microwave sensor measurements are carried out. Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz.

#### Sharing with Fixed Service (FS)

1. to be completed at a future PT-A meeting

#### Sharing with Mobile Service (MS)

1. to be completed at a future PT-A meeting

#### Sharing with Fixed-Satellite Service (FSS)

1. to be completed at a future PT-A meeting

#### Sharing with Earth exploration-satellite (passive) and space research (passive) services over the oceans.

1. to be completed at a future PT-A meeting

### 27.9-28.2 GHz (HAPS to ground) and 31-31.3 GHz (ground to HAPS)

#### Current Radio Regulation in the band 27.9-28.2 GHz and 31-31.3 GHz

HAPS has an identification at 27.9-28.2 GHz, which is allocated to the fixed, fixed satellite (Earth‑to-space) and mobile service on a primary basis. Additionally, No. 5.540 makes a secondary allocation to the fixed satellite service (space-to-Earth) for beacon transmissions intended for up-link power control at 27.501-29.999 GHz. The HAPS identification in No. 5.537A permits use within the territory of a number of countries. Such use is limited to operation in the HAPS-to-ground direction and requires HAPS systems to avoid causing harmful interference to, and precludes HAPS systems from claiming protection from, other fixed service systems or co-primary services.

The 31.0-31.3 GHz band is allocated to the fixed and mobile service on a primary basis, and the standard frequency and time signal satellite service and space research service on a secondary basis. Pursuant to RR No. 5.543A, the same countries mentioned above are permitted to use this band for HAPS in the ground-to-HAPS direction. Such use may not cause harmful interference to, nor claim protection from, other types of fixed service systems or mobile service systems[[6]](#footnote-6). HAPS must also avoid harmful interference to the radio astronomy service and EESS (passive), which have primary allocations in the 31.3-31.8 GHz band. No. 5.340 applies in 31.3-31.5 GHz for all Regions and in 31.5-31.8 GHz for Region 2. Resolution 145 (Rev.WRC-12) ensures protection of the adjacent radio astronomy service by placing a pfd limit on the HAPS ground station antenna, while adding mandatory coordination and agreement with considered neighbouring administrations. In order to ensure protection of EESS (passive), levels of unwanted power density applying to HAPS ground stations are given in No. 5.543A.

#### Sharing with Fixed Service (FS) in the bands 28 GHz and 31 GHz

1. to be completed at a future PT-A meeting

#### Sharing with Mobile Service (MS) in the bands 28 GHz and 31 GHz

1. to be completed at a future PT-A meeting

#### Sharing with Fixed-Satellite Service (FSS) in the band 28 GHz

1. to be completed at a future PT-A meeting

#### Compatibility with EESS (passive) and RAS in 31.3- 31.8 GHz

1. to be completed at a future PT-A meeting

### 47.2-47.5 GHz and 47.9-48.2 GHz

#### Current Radio Regulation in the band 47.2-47.5 GHz and 47.9-48.2 GHz

HAPS has a worldwide identification at 47.2-47.5 GHz and 47.9-48.2 GHz, which are allocated to the fixed, fixed satellite (Earth-to-space) and mobile services on a co-primary basis. 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-07), which establishes maximum transmit e.i.r.p. levels, antenna beam patterns and pfd levels for HAPS operations.

#### Sharing with Fixed Service (FS) in the bands

1. to be completed at a future PT-A meeting

#### Sharing with Mobile Service (MS) in the bands

1. to be completed at a future PT-A meeting

#### Sharing with Fixed-Satellite Service (FSS)

1. to be completed at a future PT-A meeting

### Conclusion on the suitability of using existing identified bands for HAPS

1. to be completed at a future PT-A meeting

## technical and regulatory Studies in possible new bands for haps

### Worldwide (38-39.5 GHz)

1. to be completed, if necessary, at a future PT-A meeting when conclusions on the suitability of existing bands will be known

### Region 2 (21.4-22 GHz and 24.25-27.5 GHz)

1. to be completed, if necessary, at a future PT-A meeting when conclusions on the suitability of existing bands will be known

# List of relevant documents

ITU-Documentation (Recommendations, Reports, other)

* ITU-R Agenda Item 1.14 work plan

Annex 16 to Doc. [5C/173](https://www.itu.int/dms_ties/itu-r/md/15/wp5c/c/R15-WP5C-C-0173!N16!MSW-E.docx)

* ITU-R Agenda Item 1.14 draft CPM text

Annex 15 to Doc. [5C/173](https://www.itu.int/dms_ties/itu-r/md/15/wp5c/c/R15-WP5C-C-0173!N15!MSW-E.docx)

* New draft ITU-R Recommendations/Reports under development

Annex 14 to Doc. [5C/173](https://www.itu.int/dms_ties/itu-r/md/15/wp5c/c/R15-WP5C-C-0173!N14!MSW-E.docx): PDN Report ITU-R F.[Broadband\_HAPS]

* Existing ITU-R Recommendations/Reports

ITU-R P.1409

ITU-R F.1500, F.1501, F.1569, F.1570, F.1601, F.1607, F.1608, F.1609, F.1612, F.1764, F.1819, F.1820, F.1891, F.2011, ITU-R F.2240

ITU-R SF.1481, SF1843.

CEPT and/or ECC Documentation (Decisions, Recommendations, Reports)

* ECC Report 156

EU Documentation (Directives, Decisions, Recommendations, other), if applicable

# Actions to be taken

Follow developments and studies in ITU-R to understand the additional spectrum requirements, technical characteristics and deployments scenarios for HAPS in the fixed service.

Contribute to the ITU-R studies including those called under Resolves 4 of Resolution 160 (WRC-15) with a view to assess the feasibility of new HAPs requirements while maintaining an adequate sharing environment between HAPS and other services/applications.

To review the initial studies regarding the spectrum requirements of HAPS broadband applications.

Promote CEPT view that any consideration of the frequency band 24.25-27.5 GHz under this Agenda item should not limit the possibility to identify the band for IMT on a global level under Agenda item 1.13.

To establish CEPT view on the definition of HAPS given in No.1.66A in light of latest HAPS characteristics being proposed.

# information from outside CEPT (examples of these are below)

## European Union (date of proposal)

## Regional telecommunication organisations

APT (July 2016)

TBD

ATU (date of proposal)

Arab Group (date of proposal)

CITEL (December 16)

TBD

RCC (16 September 2016)

The RCC Administrations support the need to justify spectrum requirements for gateway station and fixed terminal links for HAPS to provide broadband connectivity in the fixed service taking into account frequency bands which have been already identified for HAPS.

The RCC Administrations support necessary modifications to existing Article 5 footnotes and related WRC Resolutions to facilitate HAPS development at global or regional level.

The RCC Administrations consider that in case of modification to conditions for use of frequency bands authorized for HAPS or identification of new frequency bands for gateway station and fixed terminal links for HAPS, stations in existing services having allocations in these and adjacent frequency bands shall be protected.

The RCC Administrations consider that when conducting studies it is necessary to identify priority frequency bands non-overlapping with the bands in agenda items 1.6 (non-GSO FSS), 1.13 (IMT).

## International organisations

IATA (date of proposal)

ICAO (16 Sept 16)

If agreed ITU-R studies demonstrate there is no adverse impact on aeronautical systems including those used for the safe operation of the platform on which the HAPS resides, then support the use of fixed service allocations for HAPS provided that any regulatory actions taken within the existing allocations to the fixed service noted in Resolution 160 (WRC-15) do not constrain the potential future use of those HAPS fixed links as part of aeronautical communication systems (e.g., VSAT enhancement).

IMO (date of proposal)

SFCG (June 16)

Assuming that the ITU-R studies show a need for identification of additional spectrum for HAPS, SFCG does not support the identification of frequency bands in 21.4-22 GHz and 24.25-27.5 GHz for HAPS unless acceptable sharing conditions are agreed upon that do not adversely impact the space research, Earth exploration-satellite, or inter-satellite services.

As with AI 1.13, a particularly critical situation concerns the band 25.25-27.5 GHz which is expected to be heavily used globally by many future EESS and SRS satellite missions for data downlinks. Within this band, inter-satellite links must also remain protected. This band is indicated as a candidate band for HAPS identification only for Region 2.

Identification of the band 24.25- 27.5 GHz for HAPS under this agenda item must also be supported by studies showing the 23.6-24.0 GHz EESS (passive) band will remain protected.

EUMETNET (21 November 16)

EUMETNET (21 November 16) - No opposition to new HAPS identification provided that protection of ISS, EESS (space-to-Earth), EESS (passive) and ground-based radiometers is ensured and that guarantees is given on the long-term usage of receiving EESS earth stations (in particular in the 25.5-27 GHz band).

WMO (February 2017)

WMO does not oppose new HAPS band identifications provided that studies show a need for identification of additional spectrum for HAPS and that protection of ISS, EESS (space-to-Earth), and EESS (passive) is ensured and that guarantees are given on the long-term usage and future deployment of receiving EESS earth stations (in particular in the 25.5-27 GHz band).

The protection of EESS (passive) would require appropriate unwanted emission limits in Resolution 750 (rev. WRC-15).

Furthermore, WMO would appreciate the development of a solution to ensure the effective operation of the ground-based radiometers in the 22-28 GHz frequency band.

## Regional organisations

ESA (June 16)

ESA supports SFCG position.

Eurocontrol (date of proposal)

## OTHER INTERNATIONAL AND REGIONAL ORGANISATIONS

EBU (date of proposal)

GSMA (date of proposal)

CRAF (March 2017)

Considering the frequency band 31.0-31.3 GHz (fixed uplink) any modification to the HAPS system characteristics already defined in existing ITU-R Recommendations will lead to new compatibility studies with the passive band 31.3 - 31.5 GHz. The frequency band 38-39.5 GHz considered in Region 1 for studies regarding this agenda item is not of concern to CRAF. However, CRAF supports the RAS operations in other regions as well and requests compatibility studies to ensure the protection of RAS in Region 2 from unwanted emissions of HAPS links. No changes should be made to the RR unless acceptable sharing and compatibility criteria are developed to ensure the protection of RAS

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1. See ITU, Measuring the Information Society Report, at 9 (2015), available at <http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf>. [↑](#footnote-ref-1)
2. See ITU, Connect 2020 Agenda, available at <http://www.itu.int/en/connect2020/Pages/default.aspx>. [↑](#footnote-ref-2)
3. Measuring the Information Society Report, at 9. [↑](#footnote-ref-3)
4. Annex 14 to Document 5C/173: PDN Report ITU-R F.[Broadband\_HAPS] [↑](#footnote-ref-4)
5. Australia, Burkina Faso, Cote d'Ivoire, Mali and Nigeria [↑](#footnote-ref-5)
6. The space research service is also subject to these protections in the following countries: Armenia, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan. [↑](#footnote-ref-6)