

**Document IWG-2/49 (08.10.10)**

**IWG-2 Recommendations regarding the US Proposal on Agenda Item 1.20**

**Agenda Item 1.20:** *To consider the results of ITU-R studies and spectrum identification for gateway links for high altitude platform stations (HAPS) in the range between 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with Resolution 734 (Rev.WRC-07).*

**Summary**

IWG-2 began considering draft US proposal on agenda item 1.20 at its August 29, 2009 meeting. After thorough discussion, and after considering multiple iterations of possible US proposals, IWG-2 members were unable to reach consensus on a recommended US proposal on agenda item 1.20. IWG-2 does not believe that it is in a position to progress the work further on this agenda item at this time. Consequently, two draft US proposals were developed.

Proposal A (contained in Attachment A to this document) is supported by Stratocomm and AeroVironment and reflects the views of these companies. IWG-2 as a whole did not review and approve the text provided in Attachment A.

Proposal B (contained in Attachment B to this document) is supported by Alcatel-Lucent, Fixed Wireless Communications Coalition, Hughes Network Systems, Globalstar, Intelsat and SES World Skies, and reflects the views of these companies. IWG-2 as a whole did not review and approve the text provided in Attachment B.

IWG-2 respectfully submits this document and two attached draft US proposals to the WRC Advisory Committee for further consideration.

**ATTACHMENT A – PROPOSAL A****Document:** IWG -2\_48 (02.09.2010)**UNITED STATES OF AMERICA****DRAFT PROPOSAL FOR THE WORK OF THE CONFERENCE**

**AGENDA ITEM 1.20:** *To consider the results of ITU-R studies and spectrum identification for gateway links for high altitude platform stations (HAPS) in the range between 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with Resolution 734 (Rev.WRC-07)*

**BACKGROUND**

WRC-97 made provisions for the operation of HAPS gateway links within the FS in the bands 47.2-47.5 GHz and 47.9-48.2 GHz by Resolution **122 (Rev.WRC-07)**. Since the 47 GHz bands are susceptible to rain attenuation, WRC-2000 adopted RR Nos. **5.537A** and **5.543A**, which were modified at WRC-03 and then again at WRC-07 to permit the use of HAPS in the fixed service in the band 27.9-28.2 GHz and in the band 31-31.3 GHz in certain Region 1 and 3 countries on a non-harmful interference, non-protection basis by Resolution **145 (Rev.WRC-07)**. In addition, countries in Region 2 may use this frequency band for HAPS on a non-harmful interference, non-protection basis in accordance with Resolution **145 (Rev.WRC-07)**. Considering the high rain attenuation levels in higher frequency bands and the desirability to have greater flexibility in the choice of spectrum for gateway operations in support of HAPS networks, consideration is being given to the potential use of the 6 GHz band for HAPS gateway links.

HAPS gateway links can support backhaul connections of all types (e.g. for cellular networks and complex wireless multi-protocol networks), access to terrestrial public and private networks, data collection, exploration data, surveillance information, safety radar data, and broadcast and interactive video. Telemetry, tracking, command and control information related to the operation of the HAPS vehicle itself can also be contained in the HAPS gateway link. HAPS applications can also provide a broad spectrum of disaster response, emergency communications, remote medical assistance, distance learning, public safety and government system applications on a real time multi-mode and global basis.

**PROPOSAL****MOD USA/1.20/01****5 570-7 250 MHz**

<b>Allocation to services</b>		
<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>
<b>5 570-5 650</b>	MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B 5.450 5.451 5.452	
<b>5 650-5 725</b>	RADIOLOCATION MOBILE except aeronautical mobile 5.446A 5.450A Amateur Space research (deep space) 5.282 5.451 5.453 5.454 5.455	
<b>5 725-5 830</b> FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur 5.150 5.451 5.453 5.455 5.456	<b>5 725-5 830</b> RADIOLOCATION Amateur  5.150 5.453 5.455	
<b>5 830-5 850</b> FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Amateur-satellite (space-to-Earth) 5.150 5.451 5.453 5.455 5.456	<b>5 830-5 850</b> RADIOLOCATION Amateur Amateur-satellite (space-to-Earth)  5.150 5.453 5.455	
<b>5 850-5 925</b> FIXED FIXED-SATELLITE (Earth-to-space) MOBILE  5.150	<b>5 850-5 925</b> FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation 5.150	<b>5 850-5 925</b> FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation  5.150
<b>5 925-6 700</b>	FIXED <a href="#">ADD 5.A120</a> FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C 5.149 5.440 5.458	
<b>6 700-7 075</b>	FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE 5.458 5.458A 5.458B 5.458C	

**ADD 5.A120** For Administrations, [to be identified here and as indicated by these administrations at WRC-12], wishing to implement HAPS gateway links in the following bands that are identified for use by HAPS. 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) may also be used by gateway links for high altitude platform stations (HAPS) within the territory of these countries. Such use of two channels of 80 MHz in the fixed service allocation by HAPS in the above countries is limited to operation in HAPS gateway links and shall not claim protection from other types of fixed service systems or other co-primary services. Resolution [A120-HAPS-GATEWAY] (WRC-12) shall also apply. (No. 5.43A does not apply). Furthermore, the development of these other services shall not be constrained by HAPS gateway links.

**Reason:** A 6 GHz spectrum identification for HAPS gateway links with specified technical and operations constraints required by a Resolution would allow an operational HAPS system to provide real-time voice and data services while ensuring the protection of existing services.

**ADD USA/1.20/02**

PROPOSED RESOLUTION [A120-HAPS-GATEWAY] (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 (HAPS) in the fixed service**

The World Radiocommunication Conference (Geneva, 2012),

*considering*

- a) that ITU has among its purposes “to promote the extension of the benefit of the new telecommunication technologies to all the world’s inhabitants” (No. 6 of the Constitution);
- b) that systems based on new technologies using high altitude platform stations (HAPS) can potentially be used for various applications such as the provision of high-capacity services to urban and rural areas;
- c) that provision has been made in the Radio Regulations for the deployment of HAPS in specific bands, including as base stations to serve IMT-2000 networks;
- d) that at WRC-07, a need for adequate provision for gateway links to serve HAPS operations was expressed;
- e) that WRC-07 revised Resolution 734 to invite ITU-R to conduct sharing studies, with a view to identifying two channels of 80 MHz each for gateway links for HAPS in the range from 5 850 to 7 075 MHz, in bands already allocated to the fixed service, while ensuring the protection of existing services;
- f) that the band 5 850-7 075 MHz is already heavily used or planned to be used by a number of different services and a number of other types of applications in the fixed service;

g) that in order to accommodate the need stated in *considering d*), WRC-12 adopted No. **5.A120** to permit the use of HAPS gateway links in the fixed service in the bands 6 440 – 6 520 MHz and 6 560 – 6 640 MHz in the countries listed in the footnote, based on the study results in *considering e*);

h) that while the deployment HAPS gateway links in the band 6 440 – 6 520 MHz and 6 560 – 6 640 MHz is taken on a national basis, such deployment may affect neighbouring administrations,

*recognizing*

a) that ITU-R has studied technical and operational characteristics of HAPS gateway links in the fixed services in part of the 6 GHz band resulting in Recommendation ITU-R F.[HAPS CHAR];

b) that ITU-R has also conducted sharing studies between HAPS gateway links and other existing services leading to Recommendations ITU-R F.[HAPS GATEWAY] and ITU-R F.[HAPS MODELLING] to provide interference evaluation methodologies based on Recommendation ITU-R F.[HAPS CHAR] referred to in *recognizing a*);

c) that the World Summit on the Information Society has encouraged the development and application of emerging technologies to facilitate infrastructure and network development worldwide with special focus on underserved regions and areas,

*noting*

1 that for the purpose of protecting the Earth exploration-satellite service (passive) in the band 6 425-7 075 MHz, No. **5.458** shall apply;

2 that for the purpose of protecting the radio astronomy service in the band 6 650-6 675.2 MHz, No. **5.149** shall apply,

*resolves*

1 that the antenna pattern for both the HAPS platform and the HAPS gateway station in the bands 6 440 – 6 520 MHz and 6 560 – 6 640 MHz shall meet the following antenna beam patterns:

$$G(\psi) = G_m - 3(\psi/\psi_b)^2 \quad \text{dBi} \quad \text{for} \quad 0^\circ \leq \psi \leq \psi_1$$

$$G(\psi) = G_m + L_N \quad \text{dBi} \quad \text{for} \quad \psi_1 < \psi \leq \psi_2$$

$$G(\psi) = X - 60 \log(\psi) \quad \text{dBi} \quad \text{for} \quad \psi_2 < \psi \leq \psi_3$$

$$G(\psi) = L_F \quad \text{dBi} \quad \text{for} \quad \psi_3 < \psi \leq 90^\circ$$

where:

$G(\psi)$ : gain at the angle  $\psi$  from the main beam direction (dBi);

$G_m$ : maximum gain in the main lobe (dBi);

$\psi_b$ : one-half of the 3 dB beamwidth in the plane considered (3 dB below  $G_m$ ) (degrees);

$L_N$ : near side-lobe level (dB) relative to the peak gain required by the system design, and has a maximum value of –25 dB;

$L_F$ : far side-lobe level,  $G_m - 73$  dBi.

$$\psi_1 = \psi_b \sqrt{-L_N/3} \quad \text{degrees}$$

$$\psi_2 = 3.745 \psi_b \quad \text{degrees}$$

$$X = G_m + L_N + 60 \log(\psi_2) \quad \text{dBi}$$

$$\psi_3 = 10^{(X-L_F)/60} \quad \text{degrees}$$

The 3 dB beamwidth ( $2\psi_b$ ) is estimated by:

$$(\psi_b)^2 = 7442/(10^{0.1G_m}) \quad \text{degrees}^2;$$

- 2 that the maximum angle of deviation of the HAPS airborne antenna from the nadir should be limited to 60 degrees corresponding to the UAC of the HAPS;
- 3 that for the purpose of protecting the FSS (Earth-to-space), the pfd of the HAPS uplink shall be limited to a maximum of  $-177.7 \text{ dBW/m}^2$  in 4 kHz toward the geostationary arc;
- 4 that for the purpose of protecting the fixed wireless systems in other administrations in the band 5 850-6 725 MHz, the e.i.r.p. of the HAPS downlink shall be limited to a maximum of  $-0.5 \text{ dBW/10 MHz}$  for off-axis angles from nadir below 60 degrees;

**Reason:** A resolution is need to specify the technical and operation constraints required of HAPS systems in order to ensure the protections of services already allocated to the band.

**SUP USA/1.20/03**

#### RESOLUTION 734 (Rev.WRC-07)

#### **Studies for spectrum identification for gateway links for high-altitude platform stations in the range from 5 850 to 7 075 MHz**

**Reason:** Resolution 734 is no longer relevant since the requested studies have been completed.

**ATTACHMENT B – PROPOSAL B**

IWG -2 Doc29R3 (07.09.2010)

**UNITED STATES OF AMERICA****DRAFT PROPOSAL FOR THE WORK OF THE CONFERENCE**

**AGENDA ITEM 1.20:** *To consider the results of ITU-R studies and spectrum identification for gateway links for high altitude platform stations (HAPS) in the range between 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with Resolution 734 (Rev.WRC-07)*

**BACKGROUND:**

Different segments of the 5 850-7 075 MHz frequency band are utilized for fixed, fixed-satellite, and mobile services. Resolution **734 (WRC-07)** invites the ITU-R to study spectrum identification for gateway links for high-altitude platform stations in the range from 5 850 to 7 075 MHz. The study effort is to identify two channels of 80 MHz each for gateway links for HAPS in the range from 5 850 to 7 075 MHz, in bands already allocated to the fixed service, while ensuring the protection of existing services.

Previous WRC efforts (WRC-97, WRC-2000) had undertaken initiatives to examine HAPS types of applications in various frequency bands. Due to the fact that all previous studies were carried out in frequency bands significantly higher than 5 850-7 075 MHz, new electromagnetic compatibility (EMC) studies were conducted. The EMC studies addressed HAPS ability to coexist with mobile, fixed satellite services as well as with radiolocation service, which exists in adjacent frequency bands.

Land-based and maritime radiolocation systems operate in the lower adjacent frequency band. Fixed, mobile, and fixed-satellite systems also operate in the 5 850-7 075 MHz band. Remote sensing systems operate in the 6 475-7 075 MHz band.

The FS band is heavily utilized for point-to-point and point-to-multipoint links in many parts of the world, in particular the bands between 5 925 to 6 875 MHz. In the US alone, there are over 42,000 licenses with multiple locations and multiple frequencies in the band 5850-6875 MHz. The bands were originally used for backbone high capacity systems for FM and, subsequently, digital networks. However, they are now used primarily for backhaul for cellular mobile systems, office intranet, ethernet traffic, public safety communications traffic and for delivering traffic to the public switched and data networks, involving shorter hop systems. Introducing high altitude platform links in this band for gateway stations would make it difficult to mutually coordinate either type of system in this environment. ITU-R studies demonstrate that there would be large areas

surrounding HAPS gateway stations where FS would be difficult to coordinate and where, due to the presence of FS stations, gateway stations could not be installed.

The band 5 850-7025 MHz is an FSS uplink band that is heavily used worldwide by GSO FSS applications. The low atmospheric absorption in this band enables highly reliable Earth-to-space communication links with wide service coverage, particularly in, but not limited to, geographical areas with severe rain fade conditions. The wide coverage enables services to be provided in developing countries, to sparsely populated areas and over large distances.

This band has been used by the GSO FSS for over 40 years. The technology is mature and offers equipment at low cost. This, together with the wide coverage, has led to satellites in this band being an important part of the telecommunications infrastructure in many developing countries. Satellites operating in this band are the only efficient means for providing today global satellite coverage of the Earth.

There are approximately 160 geostationary satellites operating in the band 5 850-7025 MHz, comprising a total capacity exceeding two thousand 36 MHz transponders. Moreover, about two out of three satellites in production use this band. The use of this band by the GSO FSS includes governmental uses and international commitments within the WMO and ICAO which are essential for public security, civil aviation and weather, water, climate and environmental alerts.

Satellite services in this band currently include VSAT (“Very Small Aperture Terminal”) networks, internet services, point-to-point links, backhaul service (telephony, Internet), distribution of television programs, satellite news gathering, feeder-link for TV and data broadcasting to SMATV (“Satellite Master Antenna Television”) and DTH (“Direct-To-Home”) receivers, feeder links for the mobile satellite service. Due to their wide coverage characteristics, satellites operating in this band have been extensively used for disaster relief operations. Furthermore, in this band very high power telecommand signals, both for on-station operation and for transfer orbits (Launch and Early Operation Phase – LEOP), are required.

ITU-R studies have shown that the determining factor in sharing with the FSS is the protection of HAPS links, which would require distance separations of up to several hundred kilometers. Maintenance of such large distance separation would have a very negative impact on the US satellite licensees’ ability to further develop their systems domestically and internationally.

A portion of this spectrum, the band 6 725-7 025 MHz, is the uplink band for the FSS Allotment Plan of Appendix **30B (Rev.WRC-07)** of the Radio Regulations. The fixed-satellite service Plan (RR Appendix **30B**) is intended to preserve orbit/spectrum resources for future use, on an equitable basis among all country Members of the ITU, and is of the utmost importance to developing countries that may not have the possibility to implement satellite systems in unplanned bands (that suffer more and more from congestion) in the short-and mid-terms. Use of the band is subject to the provisions of Appendix **30B** to the

Radio Regulations, which sets out the regulatory and technical requirements to be met by FSS networks employing the band and also the protection to be afforded to those networks by systems of the other services having allocations in the band (currently the FS and the MS). The potential introduction of another source of interference, or another set of stations which require protection from Appendix 30B earth stations, would have a negative effect on the possibility of this Plan “guaranteeing in practice equitable access to the geostationary orbit.”

Feeder-links (space-to-Earth) for non-geostationary mobile-satellite service (MSS) systems are allocated in the 6 700-7 075 MHz range, at gateway earth stations. These frequencies are utilized on a world wide basis to provide connections between remote terminals and the terrestrial infrastructure. Given the necessity of tracking low earth orbit (LEO) spacecraft, near hemi-spherical coverage of the sky is required at these gateway earth stations. The reception of signals from spacecraft requires low-noise, high sensitivity amplifiers at these stations that could be overloaded by powerful signals from HAPS gateway ground stations and HAPS platform stations. It will, thus, be very difficult to site HAPS systems and still provide the required protection to MSS feeder downlink earth stations.

In many countries, satellite systems utilizing these frequencies provide the only means for communications between these remote regions and the world telecommunications infrastructure. First responders routinely use MSS systems, of which the feeder links in this frequency range are a part, to coordinate rescue and relief operations. One MSS system provides an emergency location beacon service for which the feeder links provide the vital connection between the MSS spacecraft and the terrestrial portion of the system. The introduction of HAPS gateway links into this frequency range could create an adverse interference environment impacting these critical applications.

The proposal below is for Method A of the draft CPM text. Method A proposes no change to the 5 850-7 075 MHz band. Under this method, it is envisaged that HAPS gateway links may be able to make use of the existing identified spectrum in the bands 47.2-47.5 GHz and 47.9-48.2 GHz in RR No. **5.552A** (and the bands 27.9-28.2 GHz and 31.0-31.3 GHz for the countries listed in RR No. **5.537A** and **5.543A**). There is no indication of requirement within or outside of the United States for HAPS in the band indicated in this agenda item or for any other band even those already identified for HAPS, and certainly not under the conditions indicated in Method B.

**Proposal:**

**NOC USA/1.20/01**

**5570-7250 MHz**

**Allocation to Services**

<b>Region 1</b>	<b>Region 2</b>	<b>Region 3</b>
<b>5850-5925</b>	<b>5850-5925</b>	<b>5850-5925</b>

FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.150	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation 5.150	FIXED FIXED-SATELLITE (Earth-to=space) MOBILE Radiolocation 5.150
<b>5925-6700</b> FIXED FIXED-SATELLITE,5.457A (Earth-to-space), 5.457B MOBILE,5.457C 5.149 5.440 5.458	<b>5925-6700</b> FIXED FIXED-SATELLITE (Earth-to-space),5.457B MOBILE,5.457C 5.149,5.440,5,458	<b>5925-6700</b> FIXED FIXED-SATELLITE (Earth-to-space), 5.457B MOBILE, 5.457C 5.149,5.440,5.458
<b>6700-7075</b> FIXED FIXED-SATELLITE,5.441 (Earth-to-space)(space-to- Earth) 5.458,5.458A,5.458B,5.458C	<b>6700-7075</b> FIXED FIXED-SATELLITE,5.441 (Earth-to-space)(space-to- Earth) 5.458,5.458A,5.458B,5.458C	<b>6700-7075</b> FIXED FIXED-SATELLITE,5.441 (Earth-to-space)(space-to- Earth) 5.458,5.458A,5.458B,5.458C

**Reason:** In the bands indicated, regulatory identification would be too difficult to achieve and sustain without causing constraint on the development of the services allocated to the bands of concern. Under this method, it is envisaged that HAPS gateway links may be able to make use of the existing identified spectrum in the bands 47.2-47.5 GHz and 47.9-48.2 GHz in RR No. **5.552A**, which indicates that the use of these bands by HAPS is subject to the provisions of Resolution **122 (Rev.WRC-07)**. This Resolution, in its recognizing a) states that these bands are expected to be required for both gateway and ubiquitous terminal applications. It is therefore clear that there is already spectrum designated for gateway operations for HAPS.

In addition, the bands 27.9-28.2 GHz and 31.0-31.3 GHz are also available for use by HAPS in the countries listed in RR No. **5.537A** and **5.543A**. Added flexibility with respect to spectrum to be used by gateway links could be achieved by administrations by adding their name to these footnotes (in case their names were not yet in these provisions).