

## IUCAF WRC12 Paper

23 February 2011

### IUCAF Opinions and Suggested Actions Regarding Methods to Satisfy WRC12 Agenda Items of Concern to Radio Astronomy

Abstract:

This document discusses issues involved, gives context and background, expresses IUCAF opinions and concerns, and sets out needed IUCAF and RAS actions regarding Conference Preparatory Meeting (CPM) text and preferred methods for satisfying WRC12 Agenda Items (AI).

Agenda Items are discussed in numerical order. AI of no concern are generally ignored but all AI in which WP7D took an active role (for instance by liaising to the responsible WP) are noted in detail. A few brief notes concerning AI of lesser interest appear at the end of the document.

Agenda Items involving **5.340** bands are marked with an asterisk \*

Text copied from ITU-R documents is [shown in blue](#).

The finalized CPM text discussed here and this document are online at

<http://www.nrao.edu/~hlszt/RFI/CPM/FinalCPMText.pdf>

<http://www.nrao.edu/~hlszt/RFI/CPM/IUCAFWRCPaper.pdf>

Revision history:

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## AI 1.3 (WP 5B)\*

### Statement of AI 1.3:

#### Resolution [COM6/8] (WRC-07)

Consideration of appropriate regulatory provisions for the operation of unmanned aircraft systems (UAS)

...

*resolves*

that WRC-11 consider, based on the results of ITU-R studies:

1 the spectrum requirements and possible regulatory actions, including additional allocations, to support the remote pilot in commanding and controlling the unmanned aircraft systems and in relaying the air traffic control communications, as mentioned in *considering c*);

2 the spectrum requirements and possible regulatory actions, including additional allocations, to support the safe operation of unmanned aircraft systems not covered by *resolves 1*, as mentioned in *considering d*),

*invites ITU-R*

1 to conduct in time for WRC-11 the necessary studies leading to technical, regulatory and operational recommendations to the Conference, enabling that Conference to decide on appropriate allocations for the operation of UAS;

2 that the studies referred to in *invites ITU-R 1* should include sharing and compatibility studies with services already having allocations in those bands;

3 to produce a report or a recommendation, as appropriate, on how to accommodate the radiocommunication requirements for UAS payloads,

### Background and RAS context:

This issue was considered too minor to deserve full consideration in the first version of the IUCAF White Paper but several passive bands might eventually be affected.

Studies predict the use of 8000 autonomous vehicles operating in common airspace by 2030, with a consequent need for 34 MHz for terrestrial support systems and 56 MHz for a satellite component.

### CPM text:

This is Annex 2 to the Chairman's Report for WP 5B. Here is how the CPM text summarizes its considerations:

### **1/1.3/3.4 Potential frequency bands for UAS operations and compatibility studies**

ITU-R has considered the compatibility studies on certain existing allocations and under certain conditions, where required, sharing studies on new allocations and performances and characteristics including ICAO's Standards and Recommended Practices (SARPs) of control and non payload radiocommunications systems used for UA.

The compatibility studies are structured as follows:

- For terrestrial component
  - in the existing AM(R)S allocation in the 960-1 164 MHz;
  - in possible new AM(R)S allocations in the 5 000-5 030, 5 030-5 091 and 5 091-5 150 MHz and 15.4-15.63 GHz bands.
- For satellite component
  - in the existing AMS(R)S allocation in the 5 030-5 091 MHz;
  - in new AMS(R)S allocations in the 13.25-13.4 GHz, 15.4-15.7 GHz, 22.5-22.55 GHz, 23.55-23.6 GHz bands.

### **1/1.3/4 Analysis of the results of studies**

Studies initially focus on existing allocations. They take into consideration links using terrestrial and/or satellite systems.

#### **For IUCAF and RAS:**

The issue is far too complex to summarize easily now. The studies are first trying to identify spectrum already allocated to AMS(R)S and also considering in some detail portions of the spectrum that are currently allocated to FSS, which probably isn't very happy about that. Despite sketching out a plethora of Methods, no regulatory text has been discussed and it hardly seems possible that this WRC will be in a position to justify new allocations. But birds gotta fly and fish gotta swim, so what will UAS do for communications needs while the ITU-R considers? Several **5.340** bands may eventually be affected by near or adjacent allocations.

**Statement of AI 1.4:**

1.4 to consider, based on the results of ITU-R studies, any further regulatory measures to facilitate introduction of new aeronautical mobile (R) service (AM(R)S) systems in the bands 112-117.975 MHz, 960-1 164 MHz and 5 000-5 030 MHz in accordance with Resolutions **413 (Rev.WRC-07)**, **417 [COM4/5] (WRC-07)** and **420 [COM4/9] (WRC-07)**;

**Background and RAS context:**

Only Res. 420 of AI 1.4 is of interest (so the relevant Methods in the CPM Report are the C-methods):

Resolution **420 [COM4/9] (WRC-07)**; Consideration of the frequency bands between 5 000 and 5 030 MHz for aeronautical mobile (R) service surface applications at airports.

Proposed Method C1 in the CPM Report is NOC; under this view AM(R)S needs may be satisfied within an existing allocation at 5 091 – 5 150 MHz.

Method C2 would allocate 5 000 – 5 010 to AM(R)S and proposes three connected actions: a) to change the frequency allocation table; b) to add a Footnote 5.A104 and a new WRC-12 Resolution quoted in part below:

**5.A104 Additional allocation:** The band 5 000-5 010 MHz is also allocated to the aeronautical mobile (R) service. Resolution **[A1.4\_5GHZ\_AM(R)S] (WRC-12)** shall apply.

**RESOLUTION [A1.4\_5GHZ\_AM(R)S] (WRC-12)**

**Use of the 5 000-5 010 MHz band by the aeronautical mobile (R) service and protection of the radionavigation-satellite and the radio astronomy services**

*recognizing*

*e) that restriction of the AM(R)S to surface applications at airports results in conditions such that compatibility with the radio astronomy service can be assured through geographic separation and/or coordination as necessary,*

*noting*

*d) that the use of the band 5 000-5 010 MHz by the AM(R)S needs to ensure protection of the current and planned RAS systems operating in 4 990-5 000 MHz,*

*resolves*

*5 that if the separation distance for AM(R)S stations operating in the band 5 000-5 010 MHz with respect to stations in the RAS operating in the band 4 990-5 000 MHz is less than 150 km, site-specific compatibility studies including local conditions shall be undertaken in order to ensure that RAS is protected,*

The proposed allocation at (only) 5 000 – 5 010 MHz was partly dictated by unsatisfied compatibility issues with RNSS at 5 010 – 5 030 MHz. Eventual use of the 5 000 – 5 030 MHz band by RNSS (Galileo, QZSS) may present its own problems for RAS owing to the persistent, all-sky nature of RNSS signals.

Some portions of the CPM text and *recognizing a)* of the Resolution are rather glib about compatibility but overall the proposed Resolution is quite protective of RAS operations, as long as the coordination requirement is observed by administrations.

#### **IUCAF views and Recommendations:**

Administrations supporting an allocation to AM(R)S at 5 000 – 5 010 MHz, or indeed in any spectrum band adjacent to the RAS band at 4 990 – 5 000 MHz, should protect RAS operations by including wording and mandatory local coordination conditions like those that are embodied in Resolution [A1.4\_5GHZ\_AM(R)S] (WRC-12) in the CPM Report.

## AI 1.6 Res. 950 Above 275 GHz (WP 1A), Chap. 4-3, p. 261

### Statement of AI 1.6:

1.6 to review No. 5.565 of the Radio Regulations in order to update the spectrum use by the passive services between 275 GHz and 3 000 GHz, in accordance with Resolution 950 (Rev.WRC-07), and to consider possible procedures for free-space optical-links, taking into account the results of ITU-R studies, in accordance with Resolution 955 (WRC-07)

Only Resolution 950 has been of interest to RAS (and Res. 955 has largely dissipated)

Resolution 950 (Rev.WRC-07); Consideration of the use of the frequencies between 275 and 3 000 GHz

The only proposed Method in the CPM Report suppresses Res. 950 and rewrites 5.565 as:

**5.565** A number of bands in the frequency range 275-1 000 GHz are identified for use by administrations for passive service applications. The following specific frequency bands are identified for measurements by passive services:

- radio astronomy service: 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz, 453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;
- Earth exploration-satellite service (passive) and space research service (passive): 275-286 GHz, 296-306 GHz, 313-356 GHz, 361-365 GHz, 369-392 GHz, 397-399 GHz, 409-411 GHz, 416-434 GHz, 439-467 GHz, 477-502 GHz, 523-527 GHz, 538-581 GHz, 611-630 GHz, 634-654 GHz, 657-692 GHz, 713-718 GHz, 729-733 GHz, 750-754 GHz, 771-776 GHz, 823-846 GHz, 850-854 GHz, 857-862 GHz, 866-882 GHz, 905-928 GHz, 951-956 GHz, 968-973 GHz and 985-990 GHz.

The use of the range 275-1 000 GHz by the passive services does not preclude use of this range by active services.

Administrations wishing to make frequencies in the 275-1 000 GHz range available for active service applications are urged to take all practicable steps to protect these passive services from harmful interference until the date when the Table of Frequency Allocations is established in the above-mentioned 275-1 000 GHz frequency range.

All frequencies in the range 1 000-3 000 GHz may be used by both active and passive services. (WRC-12)

### IUCAF Views and Recommendations:

The best outcome for RAS is to settle this item as quickly and easily as possible at WRC-12. IUCAF recommends that input to WRC-12 conform as closely as possible to the text of the CPM Report.

## AI 1.6 Res. 955 Free-space optical links (WP 1A), Chap. 4-9, p. 267

### Statement of AI 1.6:

1.6 to review No. 5.565 of the Radio Regulations in order to update the spectrum use by the passive services between 275 GHz and 3 000 GHz, in accordance with Resolution 950 (Rev.WRC-07), and to consider possible procedures for free-space optical-links, taking into account the results of ITU-R studies, in accordance with Resolution 955 (WRC-07)

Resolution 955 (Rev.WRC-07); Consideration of procedures for free-space optical links.

### Background and RAS context:

This issue was tied to Res. 950 at WRC07 and the mixing of two diverse issues under a single agenda item cost SG7 the responsibility for Res 950 as both aspects were given to SG1. No substantial studies for free-space optical links were conducted and all methods except for NOC were stripped from the CPM Report. The item is now just a zombie.

### IUCAF Views and Recommendations:

IUCAF recommends that administrations support NOC and suppress Res. 955 as in the CPM Report. Moreover, IUCAF recommends that administrations should not support extension of the definition of the radio spectrum to extend above 3 000 GHz, as was suggested in preliminary, later suppressed, CPM Methods to satisfy this agenda item.



## AI 1.8\* FS@71-238 GHz (WP 5C), Chap. 3-23, p. 201

### Statement of AI 1.8:

1.8 to consider the progress of ITU-R studies concerning the technical and regulatory issues relative to the fixed service in the bands between 71 GHz and 238 GHz, taking into account Resolutions **731 (WRC-2000)** and **732 (WRC-2000)**;;

Only one portion of AI1.8 is of interest because Res. 732 deals with sharing between active services:

Resolution **731 (WRC-2000)**; Consideration by a future competent world radiocommunication conference of issues dealing with sharing and adjacent-band compatibility between passive and active services above 71 GHz

*invites ITU-R*

1 to continue its studies to determine if and under what conditions sharing is possible between active and passive services in the bands above 71 GHz, such as, but not limited to, 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz;

2 to study means of avoiding adjacent-band interference from space services (down-links) into radio astronomy bands above 71 GHz;

Two classes of methods have been proposed: the A-methods are concerned with the evolution of Res. 731 and 732 while the B-methods deal with masks on the FS to protect EESS (passive), leaving the fate of Res. 731 and 732 uncertain. Therefore Methods A and B are not mutually exclusive, which is normally the case, they are complementary.

**Method A** consists of no change to the Radio Regulations at this time but with two approaches (Approach A1 – NOC Resolutions **731** and **732 (WRC-2000)**; Approach A2 – SUP Resolutions **731** and **732 (WRC-2000)** and develop new Resolutions as appropriate in the future) to allow continuation of technical and operational considerations related to FS between 71-238 GHz to be addressed in ITU-R Reports and Recommendations as appropriate. Regulatory action can then be taken based on these ITU-R documents by a future World Radiocommunication Conference as appropriate.

**Method B** consists of introducing unwanted emission power masks on the FS through footnotes in RR Article 5 attached to the FS allocations in the bands 81-86 GHz and 92-95 GHz to protect the EESS in the adjacent band 86-92 GHz, with two approaches. Approach B1 proposes mandatory masks. This approach implies some limitations on the FS. Approach B2 proposes recommended masks that may constrain the FS in

countries implementing the mask and may constrain the EESS in countries that are not implementing the mask.

### **Background and RAS context:**

The FS technology is immature and scant studies of compatibility with RAS were conducted; the CPM Report states:

The protection of radio astronomy stations operating in the band 81-86 GHz from interference from FS stations in the same band may require the establishment of exclusion or coordination area around a radio astronomy station, to be determined on a case-by-case basis taking into account specificities such as terrain elevation and additional clutter. Recommendation ITU-R RA.1031 may be used to calculate those distances. The same would apply for sharing in the bands 92-94 GHz, 94.1-95 GHz and 111.8-114.25 GHz. The regulatory provisions are already contained in RR No. **29.9** and no additional regulatory provisions are required.

### **IUCAF Views and Recommendations:**

IUCAF supports continued study of compatibility between FS applications above 71 GHz and RAS because of the emerging nature of the FS applications and their increasing appearance in FS links and applications like car radars that stand to affect RAS operations widely. However, stronger liaison between WP5C and WP7D will be required, compared to the study cycle leading up to WRC12, and IUCAF recommends to administrations that they should encourage their WP5C delegates to liaise more strongly with WP7D in such matters.

Possible successors to Res. 731 and 732 that comprise the substance of Method A2 are not given in the CPM Report. Therefore, IUCAF cannot recommend that Method A2 be favored over Method A1.

In any case, the band 226 – 231.5 GHz presently included in *invites 1* of Res. 731 is a **5.340** passive service band and should not be included in any future version of Res. 731 or its possible successors. IUCAF recommends that administrations supporting Method A1 or proposing new A-type Methods should remove this band from their considerations.

## AI 1.13 (WP 4A)

### Statement of AI 1.13:

1.13 to consider the results of ITU-R studies in accordance with Resolution 551 [COM6/13] (WRC-07) and decide on the spectrum usage of the 21.4-22 GHz band for the broadcasting-satellite service and the associated feeder-link bands in Regions 1 and 3;

### Resolution 551 [COM6/13] (WRC-07)

Use of the band 21.4-22 GHz for broadcasting-satellite service and associated feeder-link bands in Regions 1 and 3

#### *resolves*

- 1 that ITU-R continue technical and regulatory studies on harmonization of spectrum usage, including planning methodologies, coordination procedures or other procedures, and BSS technologies, in preparation for WRC-11, in the 21.4-22 GHz band and the associated feeder-link bands in Regions 1 and 3, taking into account *considering h) and i)*;
- 2 that WRC-11 review the results of the study and decide the usage of the 21.4-22 GHz band and the associated feeder-link bands in Regions 1 and 3,

### Background and RAS context:

In 2009, WP 7D sent to WP 4A a liaison statement (4A/275) noting the conditions necessary for compatibility of BSS operations in Regions 1&3 with RAS operations in Region 2: compatibility of this sort across Regions should not be a problem. Included was a paragraph of draft CPM text noting the general applicability of Res. 739 but Res. 739 is but one of a long list of like items that is noted in a table in the draft CPM text.

### CPM Text:

This is Annex 1 to the WP 4A Chairman's report. It is a huge issue that sprawls across some 50 pages of CPM text and has exposed many fault lines in the existing system for satellite notification. It presents very thorny compatibility issues without any explicit mention of RAS. There are scads of draft Methods.

### For IUCAF and RAS:

There's little reason to believe that this issue will get much attention from us but perhaps someone in Regions 1 and/or 3 has something to contribute?

## AI 1.15 Oceanographic Radar (WP 5B), Chap 2-15, p. 149

### Statement of AI 1.15:

1.15 to consider possible allocations in the range 3-50 MHz to the radiolocation service for oceanographic radar applications, taking into account the results of ITU-R studies, in accordance with Resolution **612 [COM6/15] (WRC-07)**;

Resolution **[COM6/15] (WRC-07)**; Use of the radiolocation service between 3 and 50 MHz to support high-frequency oceanographic radar operations

Reads in small part:

*resolves*

1 to invite ITU-R to identify high-frequency oceanographic radar system applications between 3 and 50 MHz band, including bandwidth requirements, appropriate portions of this band for these applications, and other characteristics necessary to conduct sharing studies;

### Background and RAS context:

These radars have been operating on a non-interference, non-protection basis under RR 4.4 but now seek shared (although primary) allocations. It was initially thought that the general absence of RAS sites on coastlines might facilitate sharing with these radars but this proved false and WP 7D eventually sent a liaison statement to WP 5B (5B/311) asking that the RAS protected bands be removed from consideration; this was done.

### IUCAF Views and Recommendations:

As long as the RAS bands are not candidates for sharing this agenda item is not of obvious concern. IUCAF recommends that administrations supporting an allocation for the radar should adopt one of the Methods proposed in the CPM Report.

**Statement of AI 1.19:**

1.19 to consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems, based on the results of ITU-R studies, in accordance with Resolution **956 (WRC-07)**;

Resolution **956 (WRC-07)**: Regulatory measures and their relevance to enable the introduction of software-defined radio and cognitive radio systems

**Background and RAS context:**

SDR is so purely a technique of radio art that only a NOC Method A has been proposed to deal with it. The following definition for CRS has been proposed within the ITU-R and published in Report ITU-R SM.2152:

*“Cognitive radio system (CRS) is a radio system employing technology that allows the system to obtain knowledge of its operational and geographical environment, established policies and its internal state; to dynamically and autonomously adjust its operational parameters and protocols according to its obtained knowledge in order to achieve predefined objectives; and to learn from the results obtained.”*

The CRS issue is really the use of systems that choose frequencies in an opportunistic manner, sensing the environment to transmit in unoccupied spectrum while consulting a set of rules (either stored internally or accessed over the air) to ascertain what is actually allowed. Such devices must respond to changing local circumstances in near real-time.

Because it is assumed within the ITU-R that the Radio Regulations will be observed, use of the pure passive **5.340** bands by CRS is not an issue -- those bands would no more be used by CRS than by non-CRS systems. Conversely, use of CRS within services that are primary or exclusive in some band would also not normally be of concern, except for the existence of local quiet and coordination rules where the usual service rules may be over-ridden to protect passive services.

Three Methods were developed for CRS in the CPM text, paraphrased from the CPM Report as follows:

Method B1:

Option A: No change to the Radio Regulations

Option B: No change to the Radio Regulations and an ITU-R Resolution providing guidance for further studies on CRS

Method B2:

Add a WRC Resolution providing guidance for further studies and guidance for the use of CRS and no other changes to the Radio Regulations.

Method B1/B would guide further study through an ITU-R Resolution (removing CRS from consideration at a future WRC) while possible development of guidelines for both study and use of CRS would remain on the WRC agenda via a WRC Resolution.

The ITU-R Resolution for Method B1/B will not be drafted until 2011 June; the draft ITU-R Resolution for Method B2 reads in part:

## DRAFT RESOLUTION [A119-CRS-METHOD-B2] (WRC-12)

### Studies on deployment and use of cognitive radio systems (CRS)

The World Radiocommunication Conference (Geneva, 2012),

*recognizing*

e) that studies need to take into account challenges associated with the capability of CRS to dynamically access frequency bands, for example bands shared with passive services;

*resolves*

1 that any radio system implementing CRS technology within any radiocommunication service shall operate in accordance with the provisions of the Radio Regulations applicable for that specific service in the related frequency band;

**Some administrations support the following text for *resolves 2*:**

2 to urge administrations when authorizing operation of CRS within a service, to take all possible measures to avoid harmful interference in bands shared with radiocommunication services with equal or higher status, such as space services (space-to-Earth), radiodetermination service, passive services (radio astronomy, Earth exploration-satellite service and space research service) and safety services,

**Other administrations support the following text for *resolves 2*:**

2 to urge administrations when authorizing operation of CRS within a service, to take all possible measures to avoid harmful interference in bands shared with radiocommunication services with equal or higher status,

*resolves to invite ITU-R*

2 to study the applicability of the cognitive capabilities and technical conditions to facilitate sharing between the services intending to deploy CRS and other radiocommunication services and the radio astronomy service;

Note that the *resolves* discuss CRS systems working within a radio service and sharing between services. Devices that are not allocated to specific radio services, for instance unlicensed devices, are not explicitly mentioned.

### **IUCAF Views and Recommendations:**

IUCAF recommends that Method A, NOC and suppression of Res. 956 with respect to SDR, is appropriate.

The Resolutions mentioned in Methods B1/B and B2 are not required for further study of CRS. Nonetheless, such Resolutions could provide a useful vehicle for recognizing the challenge of implementing CRS systems that protect passive service use and observe radio quiet zone rules. IUCAF recommends that administrations choosing or formulating a B-Method regarding CRS should include a Resolution or some other means of noting these concerns.

IUCAF further recommends that the scope of future studies should include CRS systems that are not allocated within radio services, for instance unlicensed devices and devices that are expected to operate on a non-protection, non-interference basis.

**Statement of AI 1.20:**

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 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with 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

Gateway links are supposed to tie a HAPS station to other networks, under the claim that the extensive existing allocations to HAPS for its feeder links are unsuitable.

Two Methods are described in the CPM Report, both of which suppress Res. 734. Method A is NOC, arguing that existing HAPS allocations for feeder links should suffice, while Method B grants new allocations under a limited and somewhat restrictive country footnote to the Table of Frequency Allocations, along with a WRC-12 Resolution (both described below here).

**Method B:**

The regulatory approach under this Method is to add a new footnote in the Table of Frequency Allocations of RR Article 5, and to suppress Resolution 734 (Rev.WRC-07).

Here is the proposed footnote from the CPM Report, with the list of countries [X,Y,Z,...] to be filled in later, but perhaps to include Australia, Indonesia and Korea:

5.A120 In [X, Y, Z,...]20, 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 existing 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.

*Editorial note: In the footnote above, the term “existing services” will need to be clarified at WRC-12.*

**Background and RAS context:**

Although the country footnote will have limited participation and does not protect HAPS, it is ironic that Australia and Korea, two of the likely early participants, are



among the relatively few countries in which RAS observations of the affected 5.149 band are likely to occur.

WP7D suggested in a liaison statement to WP5C that HAPS allocations would best be situated above the rest frequency of the methanol line. However, larger concerns for compatibility with other existing applications (mainly FS) rendered such considerations unimportant within WP5C.

RAS has no formal allocation and WP5C did not do compatibility studies beyond recognizing the existence of footnote **5.149**. Although the more problematic proposed HAPS downlink band is the one that is further away in frequency, the upper edge of the proposed uplink band is only 10 MHz (450 km/s) below the bottom of the band at 6 650-6 675.2 MHz noted in **5.149**. A substantial spatial separation between HAPS and RAS operations would undoubtedly be required to protect RAS observations but no detailed studies were conducted.

The HAPS allocations proposed in the CPM Report are partly predicated on Proposed Resolution [A120-HAPS-GATEWAY] (WRC-12) (p. 244 of the CPM Report) that reads in part

*recognizing*

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

*noting*

*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,*

However, Recommendation ITU-R F.[HAPS GATEWAY] and Report ITU-RF.[HAPS MODELLING] are still in draft or preliminary draft form within WP5C! WP5C's plans to put the documents in final form only in 2011 June, approve them at SG5 in 2011 November and send them to the Radio Assembly shortly before WRC-12 to be hastily approved in a kind of emergency procedure. In the meanwhile the supporting compatibility studies are unavailable for discussion.

### **IUCAF's views and recommendations:**

Compatibility studies with existing services cited in Proposed Resolution [A120-HAPS-GATEWAY] (WRC-12) will be awaiting approval when the Radio Assembly convenes just before WRC-12; they cannot provide support for new allocations to HAPS.

IUCAF recommends adoption of Method A, NOC to the RR, which allows HAPS to operate within its extensive existing allocations without further impacting other services.

IUCAF further recommends that administrations proposing or favouring new allocations to HAPS should carefully consider the possible impact on their own RAS operations or those of other administrations, in the absence of detailed compatibility studies conducted under AI 1.21 of WRC-12.

## AI 1.21\* RLS (WP 5B) Chapter 2-27, p. 161

Statement of AI 1.21:

1.21 to consider a primary allocation to the radiolocation service in the band 15.4-15.7 GHz, taking into account the results of ITU-R studies, in accordance with Resolution 614 [COM6/19] (WRC-07) (Use of the band 15.4-15.7 GHz by the radiolocation service)

Four methods are proposed in the CPM Report, where Method D is NOC and Methods A, B and C make new allocations starting at 15.4, 15.5 and 15.55 GHz respectively:

All four methods proposed to satisfy this agenda item include suppression of Resolution 614(WRC-07):

- Method A proposes a new primary allocation for the RLS in the 15.4-15.7 GHz frequency band and a possible resolution providing further clarification on the use of this band as well as taking practical steps to protect ARNS and RAS in the adjacent 15.35-15.4 GHz frequency band;
- Method B proposes a new primary allocation for the RLS in the 15.5-15.7 GHz frequency band and a possible resolution providing further clarification on the use of this band as well as taking practical steps to protect ARNS and RAS in the adjacent 15.35-15.4 GHz frequency band;
- Method C proposes a new primary allocation for the RLS in the 15.55-15.7 GHz frequency band and a possible resolution for protection of ARNS and RAS systems in the adjacent band.
- Method D proposes no changes to the Radio Regulations.

Methods A, B and C change the Table of Frequency Allocations correspondingly and include a possible footnote (partly modeled on 5.511A) to protect RAS, e.g.

**5.B121** In order to protect the radio astronomy service in the band 15.35-15.4 GHz, transmissions from radiolocation stations operating in the band 15.4-15.7 GHz shall not exceed the power flux-density level of  $-156$  dB(W/m<sup>2</sup>) in a 50 MHz bandwidth into the band 15.35-15.4 GHz, at any radio astronomy observatory site for more than 2% of the time.

### Background and RAS context:

This AI proposes to extend an existing RLS allocation at 15.7 – 17.3 GHz, to improve the performance of a radar system.

Compatibility studies (ITU-R Report M.2170) show the possibility of strong interference to RAS: on p. 163 of the CPM Report, “RAS system analysis: the worst-case

scenario shows that the out of band signal received from System-6 can be as high as to 55 dB above the protection threshold of -202 dBW at a slant distance of approximately 12 km.”

Even so, the compatibility studies described in M. 2170 depend on a largely-unexplained 70 dB attenuation of the RLS signal within the RAS band. Table 1 of M.2170 suggests that this will be achieved partly by keeping the lower end of the radar operating range a few tens of MHz above 15.4 GHz but no details are given. By contrast, Document WP5B/550 from the Ukraine (who originated Method D) shows that RLS operation down to 15.4 GHz requires 80 dB of attenuation to ensure compatibility.

Moreover, the compatibility studies were done only for the single-entry case and no attempt was made at an efd analysis of the sort that would be needed to ensure the 2% overall data-loss criterion. In draft CPM text, the proposed footnotes (like 5.B121 shown above) were worded in such a way that the 2% dataloss criterion seemed applicable to each RLS station (Iran is to be thanked for correcting this oversight from the floor in Plenary). Footnote **5.511A**, upon which the RLS footnotes are supposedly modeled, explicitly states that it is the aggregate emission that is subject to the 2% dataloss criterion.

#### **IUCAF's view and recommendation:**

No allocation to RLS should be made without a guard band between the lower end of RLS operations and the upper end of the 15.35 – 15.4 GHz passive service band. Compatibility studies did not identify the required width of such a guard band, which would presumably depend on the details of how RLS emissions could be filtered. Operating with less filtering in a narrower allocation that is set back from the passive service band might be preferable to the RLS operators once they understand the need to protect passive service operations.

Administrations proposing or choosing methods to satisfy AI 1.21 should include a guard band in any allocation to RLS, along with other protective measures like the footnotes and/or resolutions in the CPM Report. Footnote text for the Table of Frequency Allocations should, like **5.511A**, be clear that a 2% dataloss criterion is applicable to the aggregate emissions into the 15.35 – 15.4 GHz band at any RAS site.

## AI 1.22 (WP1A)

### Statement of AI 1.22:

1.22 to examine the effect of emissions from short-range devices on radiocommunication services, in accordance with Resolution 953 [COM6/4] (WRC-07);

Resolution 953 [COM6/4] (WRC 07)

Protection of radiocommunication services from emissions by short-range radio devices

*resolves*

that, to ensure that radiocommunication services are adequately protected, further studies are required on the emissions from SRDs, inside and outside the frequency bands designated in the Radio Regulations for ISM applications,

*invites ITU-R*

to study emissions from SRDs, in particular RFIDs, inside and outside the frequency bands designated in the Radio Regulations for ISM applications to ensure adequate protection of radiocommunication services,

### Background and RAS context:

Although the AI seems to concern itself mostly with RFID, it actually extends to small and/or portable devices in general and includes such complicated whole matters as UWB that tied the ITU-R in knots for years. Some of the issues are the same as for CRS: will your administration's device observe my administration's rules when you bring it with you onto my administration's territory? Will these devices in general play by the rules? What are the rules, anyway? And oh, yes, what are SRD's, exactly?

Recently WP 1A put an editor's note in a Chairman's Report asking if 5.149 bands have generally been treated as exclusion bands for SRDs, as is the case for the 5.340 bands.

### Draft CPM Text

This is Annex 5 of the WP 1A Chairman's report.

Bluntly speaking, this agenda item is a mess. There is as yet no definition of SRD's (which nonetheless are universally recognized to be just devices) and a plethora of proposed Methods (in various states of disrepair) ranging from NOC (Method A) to further study via a WRC Resolution (Method B) to footnote recognition of some as-yet unidentified bands and unspecified emission levels (Method C) to Method C+superfluous recognition of their right to operate on a non-interference, non-protection basis under a new footnote that reads like RR 4.4 but does not mention it (Method D).

The methods from the CPM text are copied below. Note that one of the major disadvantages of all the methods beyond NOC is the fear that ITU-R recognition will force the ITU-R into a position where it must take explicit steps to define the operation of SRDs and the consequent protection of radio services. This would be arduous.

**3/1.22/6.1 Method A: Keep current practice**

NOC to the Radio Regulations.

**3/1.22/6.2 Method B: Add a general WRC Resolution to study the regional and global harmonization of SRDs**

An example of a draft general WRC Resolution [A122-SRD-METHOD-B] (WRC-12) on the use of the radio-frequency spectrum by short-range radio devices is provided below.

**3/1.22/6.3 Method C: Recognize a limited number of harmonized frequency bands and emission levels (WRC-12 Resolution or regulatory changes in Article 5)**

**ADD**

5.XXX {to be developed, note equivalent to RR No. 5.150.}

**3/1.22/6.4 Method D: Add RR provisions to define SRD applications and their conditions of operation**

**ADD**

5.XXX SRD applications may operate in the bands [ZZZZ-ZZZZ] MHz on the condition that no harmful interference shall be caused to any radiocommunication service (including the radio astronomy service, see No. 4.6), and that no claim shall be made for protection of these devices against harmful interference originating from radiocommunication services.

*Editor's note: in order to compare this proposed footnote with footnotes RR Nos. 5.138 and 5.150 it might be useful to have a definition of SRDs [to be developed by SG1 prior to WRC-12].*

**For IUCAF and RAS:**

Who knows?

**[All allocations to GSO systems only]**

**Statement of AI 1.25:**

1.25 to consider possible additional allocations to the mobile-satellite service, in accordance with Resolution 231 [COM6/21] (WRC-07);

Resolution [COM6/21] (WRC-07); Additional allocations to the mobile-satellite service with particular focus on the bands between 4 GHz and 16 GHz

**Background and RAS context:**

MSS is seeking service links (telephone handset-satellite transmissions) with 250 – 350 MHz bandwidth in each direction and the following bands are under consideration:

Frequency band	MSS direction (DL = downlink, UL = uplink)
5 150-5 250 MHz	DL
7 055-7 250 MHz	DL
8 400-8 500 MHz	UL
10.5-10.6 GHz	DL
13.25-13.4 GHz	DL
15.43-15.63 GHz	UL

All of the proposed allocations are to GSO satellites, so this is not an Iridium venture. Note that the ground component of the allocation (the so-called MES = mobile earth stations) are telephone handsets. Here are quotes from the CPM Report summarizing compatibility with RAS:

**5/1.25/4.4.5 Compatibility with the radio astronomy service**

MSS downlink operations in the band 10.5-10.6 GHz are compatible with radio astronomy applications operating in the band 10.6-10.7 GHz but some filtering of the MSS satellite emissions of about 29 dB would be required in order to meet the protection criteria for continuum observations of  $-160 \text{ dB(W/m}^2\text{)}$  in the band 10.6-10.7 GHz.

**5/1.25/4.6.4 Compatibility with the radio astronomy service in the band 15.35-15.4 GHz**

MSS uplink operations in the band 15.43-15.63 GHz are expected to be compatible with radio astronomy applications operating in the band 15.35-15.4 GHz assuming some minimum separation distance, and/or some additional filtering on the MES emissions to meet the protection criteria for continuum observations of  $-156$  dB(W/m<sup>2</sup>) in the band 15.35-15.4 GHz. It should be noted that there is a frequency separation of 30 MHz between the proposed MSS allocation and the radio astronomy service. Further studies are required.

And later in the Report where Methods are discussed, here is a disadvantage for Method D2 that makes an allocation to MSS at 10.5 – 10.6 GHz - see how well you think this summarizes the text excerpted above from 5/1.25/4.4.5;

Measures for protection of the RAS in the adjacent band, 10.6-10.7 GHz, may be required. This could be through use of Recommendation ITU-R RA.769, pfd limits, or pfd threshold levels for consultation.

### **IUCAF Views and Recommendations**

Studies have not shown compatibility between RAS operations and MSS operating in the 10.5 – 10.6 and 15.43 – 15.63 GHz bands, nor have they indicated how incompatibility might be mitigated in practical terms (the consultation noted above is an ad hoc process that would not lead to restrictions on MSS)

IUCAF recommends that administrations oppose allocation of the 10.5 – 10.6 GHz and 15.43 – 15.63 GHz bands to MSS.

IUCAF recommends that administrations considering new allocations to MSS also consider the implications of the suggestion that MSS systems be redefined to include registration of a complementary ground component (CGC; ATC in the US), as noted in the IUCAF discussion of AI 7 below.



## AI 7 (WP 4A (technical) & SC (regulatory))

AI 7: to consider possible changes in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference: “Advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks”, in accordance with Resolution 86 (Rev.WRC-07);

The US has introduced an aspect of concern to RAS and (other services using L-band) in this Agenda Item that otherwise concerns notification of satellite frequency assignments and was of little obvious importance to us. Specifically, the US has very recently waived some of its rules to allow spectrum allocated to MSS (earth-space) to be used domestically for the complementary ground component (CGC; in the US this is known as an alternate terrestrial component or ATC) of a sort-of MSS system that in actuality has no satellite component! That is, the FCC has allowed the use of L-band MSS spectrum at 1 525-1 544 MHz, 1 545-1 559 MHz, 1 626.5-1 645.5 MHz and 1 646.5-1 660.5 MHz so that a company called LightSquared can provide terrestrial wireless broadband without the usual obligation carried by a MSS system to involve transmitting to a satellite.

The highest 0.5 MHz of the affected spectrum is shared between MSS (earth-space) and RAS. Unlike the rest of the world where it is “protected” by 5.149, 1660.5-1668.4 MHz is a pure passive service band in the US.

In CPM/152 the US notes: “Currently, the Radio Regulations lack adequate regulatory provisions for associating notification and recording of the complementary ground component (“CGC”) of Integrated MSS Systems with its MSS component. It is essential to recognize this association and give consideration to both elements of these networks in the bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 626.5-1 645.5 MHz and 1 646.5-1 660.5 MHz.”

Document 152 thus proposes a general WRC12 resolution that would allow notification of its particular spectrum use, that is, it seeks ITU-R-wide recognition of its own particular and highly peculiar spectrum sharing. If accepted by ITU-R, the route would be open for other administrations to follow the US, potentially opening wide swaths of L-band to terrestrial transmitters all over the globe, despite studies showing severe interference to existing systems.

ITU-R studies are ongoing but results to date have shown a wide variety of interference to established systems (for instance see CPM/135 submitted in response to US plans) and news reports are beginning to appear in the press of widespread problems with interference to GPS, for instance

<http://www.gpsworld.com/gnss-system/news/data-shows-disastrous-gps-jamming-fcc-approved-broadcaster-11029>



## AI 8.2

### Statement of AI 8.2:

8.2 to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, taking into account Resolution **806 (WRC-07)**;

### Resolution **806 (WRC-07)**

*resolves to give the view*

2 on the basis of proposals from administrations and the Report of the Conference Preparatory Meeting, and taking account of the results of WRC-11, to consider and take appropriate action in respect of the following items:

2.1 to consider spectrum requirements and possible additional spectrum allocations in the radiodetermination service to support the operation of unmanned aerial systems (UAS) in non-segregated airspace;

2.2 to review the use of the band 5 091-5 150 MHz by the fixed-satellite service (Earth-to-space) (limited to feeder links of the non-GSO mobile-satellite service) in accordance with Resolution **114 (Rev.WRC-03)**;

### Background and RAS context:

TBD

### For IUCAF and RAS:

Well, what DO we want to see on the agenda?

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More Briefly:

AI 1.2 (WP 1B) Pie in the sky? Doesn't seem to tinker with passive service definitions yet.

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AI 1.5 (WP 5C) ENG. A bewildering variety of options ranging from maintaining country databases to trying to coerce manufacturers to recognize common frequencies.

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AI 1.7 (WP 4C) Compatibility AMSRS and MSS. Regional catfight one admin having some problems

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AI 1.14 (WP 5B) Radiolocation in the range 30-300 MHz for space debris tracking. They opted for a band at 154-156 MHz.