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| **The 4th Meeting of the APT Conference Preparatory Group for WRC-15 (APG15-4)** | | **Document**  **APG15-4/OUT-11** | |
| 09 – 14 February 2015, Bangkok, Thailand | | **13 February 2015** | |

**Working Party 3**

**PRELIMINARY views on WRC-15 agenda item 1.5**

**Agenda Item 1.5:**

*to consider the use of frequency bands allocated to the fixed-satellite service not subject to Appendices* ***30****,* ***30A*** *and* ***30B*** *for the control and non-payload communications of unmanned aircraft systems (UAS) in non-segregated airspaces, in accordance with Resolution* ***153 (WRC-12)***

**1. Background:**

Unmanned aircraft systems (UAS) consist of an unmanned aircraft (UA) and associated unmanned aircraft control station (UACS), control links and satellite systems.

An increase of the worldwide use of UAS is expected. The operation of unmanned aircraft together with piloted aircraft in non-segregated airspaces is becoming important for the further development of UA applications with many diverse requirements. For safe flight operations reliable communication links for UA and associated UACS, control links and satellite systems are essential. These links consist of the links between the remote pilot and satellite UACS, on the one hand, and between the satellite and UA, on the other hand, to command and control the UA and to relay air traffic communications.

Currently, UA operations have been restricted to segregated airspaces where separation from manned aircraft can be assured. However, it is an objective of some APT Members that UA be enabled to operate together with manned aircraft in non-segregated airspace and, to the extent practicable, use globally harmonized spectrum. The facilitation of this objective will necessitate the development of safe mechanisms for the control and non-payload communications (CNPC) of UAS.

The requirements of numerous UAS applications for communications beyond line of sight will necessitate the use of satellite communications to provide all, or components of, the CNPC for UAS. It may not be technically feasible to rely on terrestrial systems alone to support the CNPC requirements of UAS.

ICAO has identified seven conditions to be addressed by the studies.

ICAO is responsible for developing the technical Standards and Recommended Practices (SARPs) for CNPC to ensure safe operation of UAS in non-segregated airspace. UAS CPNC operations in non-segregated airspace need to satisfy ICAO SARPs requirements provided that reliable links betweenthe remote pilot and satellite (UACS), on the one hand, and between the satellite and unmanned aircraft (UA) on the other hand are ensured.

On the other hand, the interference management of frequency assignments and implementation of the Radio Regulations are matters to be dealt with by ITU Administrations. CNPC links must meet specific Required Communications Performance (RCP) to satisfy the aviation safety requirements. UAS CNPC links operated on frequencies in FSS allocations would have to be validated to meet those SARPs. Regulatory measures will also be required to address the technical and operational characteristics, interference and regulatory environments associated with UA CNPC links. In addition regulatory measures will be required to satisfy the safety related requirements.

In order to address the requirements of UAS CNPC under Agenda item 1.5 of WRC-15 ITU-R is developing a document towards preliminary draft new Report covering the technical, operational, regulatory, interference environment and safety aspects of UAS CNPC. To this effect, relevant elements of Report ITU-R M.2233 were considered in the development of this document. In particular performance and service availability of the CNPC link.

However, this document after almost three years of hard work has not been agreed by ITU-R. There is a wide divergence of views among the ITU-R participants on almost all elements of this voluminous document towards a preliminary draft new Report.

At WRC-12, the spectrum requirements of UAS were considered and several new allocations were made to support UAS operations under Agenda item 1.3.

At that conference there was a proposal from a few administrations to allow UAS to use FSS allocations; however, WRC-12 did not address this proposal for beyond-line-of-sight (BLOS) operation because of a lack of supporting studies (Report ITU-R M.2233 was not sufficient to address all technical, operational, interference environment, regulatory and safety aspects of the UAS CNPC). This proposal was instead carried over to WRC‑15 in Agenda item 1.5 for further consideration. Therefore, at WRC-12 no new satellite allocations were made to support BLOS UAS CNPC. The aeronautical mobile satellite (R) service (AMS(R)S) in the frequency range 5 000-5 150 MHz, previously allocated through footnote No. **5.367**, is now in the Table of Frequency Allocations in Article **5** of the RR. The requirement for BLOS (satellite) communications (54 MHz) may not be satisfied in the limited spectrum available in the frequency bands 1.5/1.6 GHz, and no AMS(R)S satellite system currently operates in the frequency range 5 000-5 150 MHz to support current/near-term UAS CNPC.

Existing systems operating in the FSS in the unplanned frequency bands 4/6 GHz, 12/14 GHz and 20/30 GHz have spectrum capacity available that may meet the requirements for BLOS communications and could be used for UAS CNPC provided that all technical, operational, interference environmental and regulatory as well as safety aspects including principles of UAS as referred to in Resolution **153** **(WRC-12**) are fulfilled. However the FSS is not recognized by the ITU as a safety service. Some of these systems have been notified for registration under Article **11.41** and as a consequence are subject to harmful interference which could result in mis-command of the unmanned aircraft intended to operate in a non‑segregated airspace together with other piloted aircraft (passenger and/or cargo aircraft). The assignment and use of frequencies recorded under **11.41** with respect to the application of **4.10** would require redundancy in the event of harmful interference.

It is noted that for those FSS links that are coordinated, the specific agreement are generally not publicly available.

Moreover, for those FSS links that are coordinated, the level of coordination negotiated between various satellite operators are not available to enable the thorough examination of the status of probability of interference, taking into account that FSS as used today which are located at orbital positions with just 2-3 degrees separated from each other suffering from considerable amount of interference (in the majority of the cases much beyond the coordination trigger level of overall link noise threshold of Delta T / T of 6%). These links would need to meet the performance availability and service availability of the communication links required for the safe operation of UAS CNPC in order to satisfy **4.10**. Moreover there is no mechanism or provisions to prevent the occurrence of instantaneous or repeated interference to FSS links used for UAS CNPC.

WRC-12 resolved to study this topic further and agreed on Agenda item 1.5 of WRC-15 to consider, if and under which provisions the use of certain frequency bands allocated to the fixed satellite service, except those allocated under Appendices **30**, **30A** and **30B**, are appropriate for the CNPC of UAS in non-segregated airspace. Systems operating in the FSS have the capability to provide reliable BLOS communications between unmanned aircraft and control stations, and UAS already operate in segregated airspace using FSS frequency bands for unmanned aircraft to satellite links under No. **4.4** of the Radio Regulations.

It is also necessary to take into account existing and future satellite networks when planning for growth of the use of FSS resources for UAS.

The *responsible group* for WRC-15 Agenda item 1.5, ITU-R Working Party (WP) 5B has developed draft CPM text as included in the draft CPM Report (Document [CPM15-2/1](http://www.itu.int/md/R12-CPM15.02-C-0001/en)) and the associated working document towards a preliminary draft new Report ITU-R M.[UAS-FSS] – *Technical and operational characteristics, interference and regulatory environments associated with the use of frequency bands allocated to the fixed-satellite service not subject to Appendices* ***30****,* ***30A****, and* ***30B*** *for the control and non-payload communications of unmanned aircraft systems in non-segregated airspace*. At the November 2014 meeting of WP 5B it was noted by administrations attending the meeting that with the help of appropriate contribution this Report might be upgraded to a DNR during the July 2015 meeting of WP 5B (annex 18 to document [5B/761](http://www.itu.int/md/R12-WP5B-C-0761/en)). However, not all administrations were able to be represented at this meeting, and at the previous meeting of WP 5B there was no consensus on several parts of the text and for that reason the entire text was placed between bold square brackets (annex 40 revision 1 to Document [5B/636](http://www.itu.int/md/R12-WP5B-C-0636/en)).

In its introductory text to the Draft CPM Report (Document [CPM15-2/1](http://www.itu.int/md/R12-CPM15.02-C-0001/en)), the CPM-15 Management Team identified a number of issues that should be taken into account by administrations in the preparation of contributions to the second session of the CPM. For Chapter 3, agenda item 1.5, section 3/1.5/4, the CPM Management Team noted that no texts with regard to the analysis of the results of studies were developed as no agreement on this issue was reached by the responsible group and that text for this section needs to be developed in line with the requirements of Resolution ITU-R 2-6.

As a *contributing group*, WP 4A has developed preliminary draft new Recommendation ITU-R S.[FSS-REF\_FOR\_UA] *Technical and operational characteristics of unmanned aircraft control and non-payload satellite communication links operated in certain frequency bands allocated to the fixed-satellite service not subject to RR Appendices* ***30****,* ***30A*** *and* ***30B*** (annex 14 to [4A/591](http://www.itu.int/md/R12-WP4A-C-0591/en)). However, based on the agreement reached at the Working Party 4A this preliminary draft Report will not be further developed until WRC-15 decides on the Agenda item 1.5. In other words, this Report would in no way be used or suitable for the purpose of satisfying some or all difficulties of the technical and operational characteristics of UAS CNPC, until a decision has been made whether or not to support the provision of this Agenda item at WRC-15.

The working document towards a preliminary draft new Report ITU-R M.[UAS-FSS] uses the following terminology and assumptions:

**Control and non-payload communications (CNPC)** is understood to be the radio links, used to exchange information between the UA and UACS that ensure safe, reliable, and effective UA flight operation. The functions of CNPC can be related to different types of information such as telecommand messages, non-payload telemetry data, support for navigation aids, air traffic control voice relay, air traffic services data relay, sense and avoid target track data, airborne weather radar downlink data, and non-payload video downlink data.

**Segregated Airspace** is Airspace of specified dimensions allocated for exclusive use to a specific user(s)

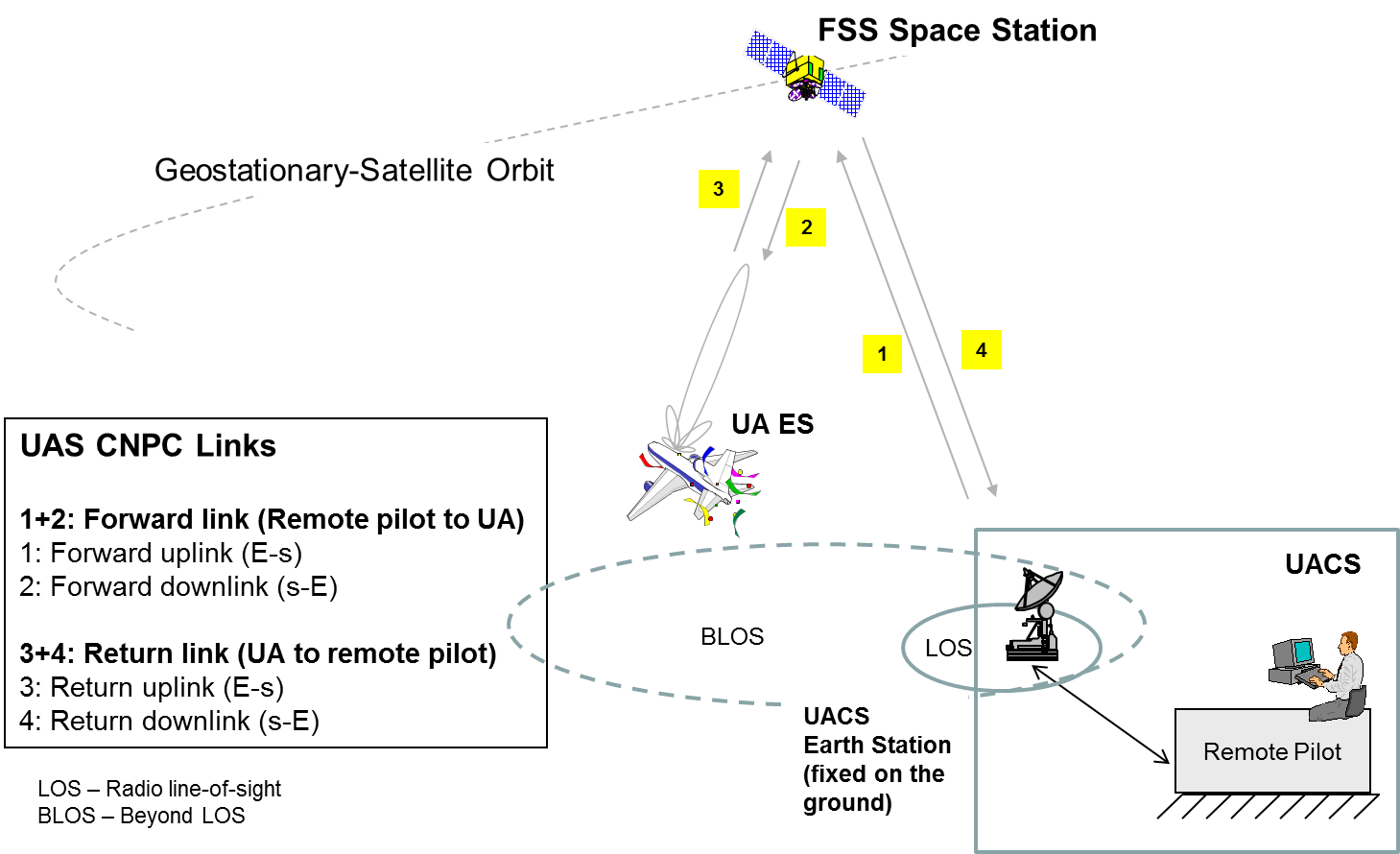
**Non-segregated Airspace** is airspace other than those designated as segregated airspace

As shown in Figure 1, a typical unmanned aircraft system (UAS)[[1]](#footnote-1) in this context comprises an:

* **Unmanned aircraft (UA):** designates all types of remotely controlled aircraft;
* **UA control station** **(UACS)**: facility, typically comprising earth stations for direct radio line-of-sight (LOS) and BLOS and a connected piloted control site with all processing facilities, from which a UA is remotely controlled. It is understood that an UACS using satellite communication is located at a fixed point; and
* **Geostationary satellites**: A geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth’s equator and which thus remains fixed relative to the Earth; by extension, a geosynchronous satellite which remains approximately fixed relative to the Earth. (RR No. **1.189**).

Figure 1

Typical BLOS CNPC links in an Unmanned Aircraft System



The communication between a remote pilot in charge of the flight and his/her aircraft needs a full-duplex communication comprising of the forward- and return link with the following definitions:

* **Forward link:** CNPC-link from the remote pilot (located at the UACS) to the unmanned aircraft (UA) through a satellite.
* **Return link:** CNPC-link from the unmanned aircraft (UA) to the UACS through a satellite.

The **Control and non-payload communications (CNPC)**[[2]](#footnote-2) link data comprises three components to ensure safe, reliable, and effective UA flight operation:

* **Telecommand** (forward) control messages and **telemetry** (return) data relevant to enable full remote control all UA functions;
* **ATC relay** communication (to ensure at the remote pilot site the same situational awareness of VHF voice communication representative for the radio vicinity at the current location UA; and
* **Sense and avoid (S&A) data:** comprising target track data, airborne weather radar data corresponding to the piloting principle of “see and avoid” which is used in all airspace volumes where thepilot is responsible for ensuring separation from nearby aircraft, terrain and obstacles.

Although the overall performance of forward and return links is driven mainly by the links 2 and 3 between the UA and the satellite, the regulatory conditions for each of the individual links shown in Figure 1 are different and should be discussed individually in working document towards preliminary draft new Report ITU-R M.[UAS-FSS].

The studies have considered the bidirectional links between an unmanned aircraft earth station and associated FSS space station (E to s and s to E) as well as the FSS space station and the unmanned aircraft control earth station (E to s and s to E). They have been developed in co-operation with ICAO. It should be noted that the UA Earth station is considered as an aeronautical mobile Earth station intended to operate with the FSS. Such use has two major deficiencies: a) the interference environment of aeronautical mobile Earth station has not yet been studied and b) from the regulatory and procedural point of view and aeronautical mobile earth station cannot use FSS links due to the fact that under the current regulations the class of station of such Earth station does not match with the class of station of the corresponding space station. This would result that the UA earth station cannot be notified under Article 11 of the RR to benefit from international recognition and protection from potential interference which are two essential elements required for the safety of flight for UAS CNPC.

At the same time ICAO has been working on the aeronautical operational, institutional and technical requirements. Due to the different time frames ICAO has not been able to provide the technical performance characteristics in terms of availability, reliability and continuity against which FSS links and or systems can be judged. However ICAO through their position have provided 7 conditions that would have to be met whilst taking into account ICAO’s strategic objective that aeronautical systems should operate in spectrum allocated to an appropriate aeronautical safety service:

1. *“That the technical and regulatory actions should be limited to the case of UAS using satellites, as studied, and not set a precedent that puts other aeronautical safety services at risk;*
2. *That all frequency bands which carry aeronautical safety communications need to be clearly identified in the Radio Regulations;*
3. *That the assignments and use of the relevant frequency bands have to be consistent with article 4.10 of the Radio Regulations which recognizes that safety services require special measures to ensure their freedom from harmful interference;*
4. *Knowledge that any assignment operating in those frequency bands:*
   1. *is in conformity with technical criteria of the Radio Regulations;*
   2. *has been successfully co-ordinated, including cases where co-ordination was not completed but the ITU examination of probability of harmful interference resulted in a favorable finding, or any caveats placed on that assignment have been addressed and resolved such that the assignment is able to satisfy the requirements to provide BLOS communications for UAS; and has been recorded in the International Master Frequency Register;*
5. *That interference to systems is reported in a transparent manner and addressed in the appropriate time-scale;*
6. *That realistic worst case condition with inclusion of a safety margin can be applied during compatibility studies;*
7. *That any operational considerations for UAS will be handled in ICAO and not in the ITU.”*

In the absence of any technical performance requirements from ICAO it has not been possible to assess whether an FSS network, which may include one or more satellite links to the unmanned aircraft, is capable of supporting those performance requirements. However the following radio regulatory issues have been identified that any method would have to address:-

1. The current definitions in Article **1** for an aircraft earth station and for the fixed satellite service are inconsistent with the provision of a link between an unmanned aircraft earth station and a fixed satellite station;
2. The status of fixed satellite assignments recorded in the MIFR, including the implications for the protection of those networks and consistency as a safety service.

Any method would have to address these issues and the ICAO conditions.

No agreement was reached at the meeting of Working Party 5B on the results of studies prior to the deadline for draft CPM text. The drafting of the Report continued at the November 2014 meeting (refer [5B/761 Annex 18](http://www.itu.int/md/R12-WP5B-C-0761/en)). It is acknowledged, however, that not all views were taken into account due to meeting clashes. The studies will continue at the July 2015 meeting of WP 5B.

**Methods to Satisfy the Agenda Item**

The following methods are currently being considered by WP 5B to satisfy this agenda item:

**Method A** – Add provisions in Radio Regulations for using FSS for UAS CNPC applications

To enable the use of the Fixed Satellite Service (FSS) for UAS CNPC applications operated in accordance with ICAO standards and procedures, through a footnote, such use shall be in accordance with an associated Resolution. Compliance with this Resolution will satisfy all required technical, operational, and regulatory conditions. This Method will permit FSS links supporting UAS CNPC to operate without adverse effects to existing and future FSS networks.

The footnote shall only be applied to frequency bands allocated to the FSS not subject to Appendix **30**, **30A**, or **30B** in the frequency ranges 10.95-14.5 GHz, 17.8-20.2 GHz and 27.5-30 GHz, as appropriate, for which studies have been conducted.

However, the above-mentioned Resolution which is the essential part of Method A was not discussed. Such a Resolution should contain and respond to all technical, operational, interference, regulatory and safety aspects of the Method A which unfortunately was not discussed.

**Method B** – No change to the Radio Regulation (NOC)

*Reasons*

There are considerable technical, operational and regulatory obstacles for the use of FSS for UAS CNPC links. Moreover, existing allocations for AMS(R)S as well as AMSS and MSS, under certain conditions would satisfy the requirements for UAS CNPC in the frequency bands of these services.

Each of the above-mentioned methods have advantages and disadvantages.

As a general rule, participants at ITU-R Study Groups developing CPM text should have the opportunity to comment on the texts of all advantages and disadvantages. This had been a continued practice since the first CPM in 1995. However, at the last and final meeting of WP 5B prior to the deadline for draft CPM text the proponents of Method A did not permit debate on the advantages of Method A to be discussed and thus they felt free to add whatever they wished to add as advantages to that method.

Method A has as significant number of disadvantages as discussed in the draft CPM Report.

**2. Documents**

***2.1 Input Documents:***

APG15-4/INP[-12 (Rev.1)](http://www.apt.int/sites/default/files/2015/02/APG15-4-INP-12Rev.1_Thailand_WP3.docx) (THA), [-18](http://www.apt.int/sites/default/files/2015/01/APG15-4-INP-18_KOR_WP3.docx) (KOR), [-25](http://www.apt.int/sites/default/files/2015/01/APG15-4-INP-25_NZL3_-_WP3.docx) (NZL),[-38](http://www.apt.int/sites/default/files/2015/02/APG15-4-INP-38_IRN_WP3.docx) (IRN),[-43](http://www.apt.int/sites/default/files/2015/02/APG15-4-INP-43_CHN_PV_WP3.docx) (CHN), [-57](http://www.apt.int/sites/default/files/2015/02/APG15-4-INP-57_AUS_PV_WP3.docx) (AUS),[-71](http://www.apt.int/sites/default/files/2015/02/APG15-4-INP-71_MLA_WP3.docx) (MLA), [-79](http://www.apt.int/sites/default/files/2015/02/APG15-4-INP-79_J_PV_WP3.docx) (J),[-93](http://www.apt.int/sites/default/files/2015/02/APG15-4-INP-93_VTN_PV_WP3.docx) (VTN)

***2.2 Information Documents:***

[APG15-4/INF-14](http://www.apt.int/sites/default/files/2015/01/APG15-4-INF-14_RCC_position_WRC-15_ENG_05_12_2014.docx) (RCC), [-18](http://www.apt.int/sites/default/files/2015/02/APG15-4-INF-18_ITU_BR_-_Update_on_preparation_status_of_CPM-15RA-15WRC-15_v1.pdf) (BR ITU), [-19](http://www.apt.int/sites/default/files/2015/02/APG15-4-INF-19_CEPT_Presentation_Regional_org__February_2015.pdf) (CEPT), [-20](http://www.apt.int/sites/default/files/2015/02/APG15-4-INF-20_CITEL_Preparation.pdf) (CITEL)

**3. Summary of Discussion:**

There were several concerns that there have been no agreement on technical, operational, regulatory, interference and safety aspects of the use of the FSS for UAS CNPC. Moreover, there was concern that in order to protect such operation there will be an impact on other FSS operation. There was discussion of the unique nature of the CNPC links and the special requirements in RR Article **4.10** in respect to applications related to safe operation. There was some discussion that this may impose unnecessary constraints on the future development of the selected bands for regular FSS. On the other hand there was no consensus that the FSS should be granted to have the same degree of safety aspects due to the fact that such course of action would impede future coordination of FSS among satellite operators.

* 1. **Suitability of FSS for UAS control and non-payload communication**

*Radio link between the unmanned aircraft control stations and the fixed satellite service space station (Links 1 and 4)*

These links provide connection between the control station and the satellite for which the current FSS allocation as mentioned above would be used. It was highlighted that if Link 1 and Link 4 are operated as typical FSS links and their characteristics is identical to typical FSS applications there would be no need for compatibility studies. However if the characteristics are more sensitive than those of specific or typical earth stations there are regulatory consequences that need to be addressed. However, 48% of the FSS links intended to be used for this purpose have not completed the required coordination and operating under RR **11.41** and as a consequence cannot cause interference nor claim protection from interference with respect to networks previously recorded in the MIFR for which agreement has not been obtained. The remaining 52% are also coordinated under the traditional FSS use for commercial operation under the probability of interference they accepted during coordination. The assignment and use of these frequencies for UAS CNPC would require the satellite operator to meet a high degree of performance availability and service availability of the communication links required for the safe operation of UAS CNPC in order to satisfy **4.10**.

It was noted that studies are yet been carried out in regard to compatibility with other services for Link 1 and Link 4.

*Radio links between the unmanned aircraft earth station and the fixed satellite service space station (Links 2 and 3)*

Unmanned aircraft earth station is of a mobile nature (aeronautical mobile earth station) and thus may be considered not compatible with the definition of the FSS to operate within that service.

As described in Method A, some administrations hold the view that WRC-15 could authorize such use by adopting new footnotes. It was noted that such action by WRC-15 may contrast with the decision taken at WRC-12 under Agenda item 1.2 as such a decision could have far reaching consequences to the scope of the space services definition in the RR and could create a series of complex regulatory environments which may hamper the operation of the space service.

The mobile nature and the area wide operation of the earth stations onboard aircraft have been taken into account in sharing studies, although these studies have not been completed.

ITU-R working documents refer to the potential for interference from incumbent services to earth station receivers on unmanned aircraft operating in the frequency bands 10.95-11.20 GHz, 11.45‑11.70 GHz, 11.70-12.20 GHz in Region 2, 12.20-12.50 GHz in Region 3, and 12.50‑12.75 GHz in Regions 1 and 3. These incumbent services are FSS, FS, MS, RDS, SRS, MSS, BSS. The compatibility between incumbent services and UAS-CNPC networks are discussed in annexes 5, 6 and 7 of Report ITU-R M.[UAS-CNPC]. However, this document is still at early stage of development and no elements have been agreed. The introductory part of this Report describes the non agreement and divergence of views on all parts of the Report.

* 1. **Status of assignments recorded in the Master International Frequency Register (MIFR)**

APT Members noted that about 50% (refer [4A/240](http://www.itu.int/md/R12-WP4A-C-0240/en)) of satellite networks are today seen to be brought into use without completion of all the required coordination with other satellite networks; that is these networks do not have favourable findings in the MIFR with respect to RR No. **11.32**, or favourable findings under **11.32A**. This means that both the operational limitations (in terms of protecting other networks) and interference scenario (in terms of being protected against interference from other networks) are not fully determined.

APT Members noted that assignments could also be recorded in the MIFR without completing coordination via favourable findings reported under **11.32A**/**11.33**, or reviewed under **11.41A** and **11.41B**. However APT Members also noted that such type of recording may not meet the safety requirements of UAS CNPC.

* Coordinated limits are set out in bilateral agreements between countries and the details of these are seldom released to ITU and are normally not publicly available.
* The degree of safe and predictable operation of the UAS depends amongst others on:

1. the degree of coordination of the used satellite network as well as that of neighbouring satellite networks;
2. the licensing conditions of the various countries involved in the operation of the used and the neighbouring satellite networks;
3. the contractual arrangements of the satellite operators in the vicinity of the used satellite network with their service providers and in turn their end users and the degree of protection obtained through the conditions prescribed in these contracts and licenses; and
4. the ability to safeguard and ensure compliance with prescribed limits and avoidance of harmful interference.

At its May 2012 meeting, ITU-R WP 4A received a liaison statement from WP 5B on use of the fixed-satellite service to support safe operation of UAS in non-segregated air space. During the discussion associated with this liaison statement, WP 4A agreed to “request the BR to provide information on the status of FSS frequency assignments currently within the MIFR (e.g. initially recorded under No. **11.38** or No. **11.41**, currently recorded provisionally or definitively, etc.)”, (see § 4.2 of Document [4A/61](http://www.itu.int/md/R12-WP4A-C-0061/en), Chairman’s Report).

The Radiocommunication Bureau provided a summary of the status of frequency assignments recorded in the MIFR (status 50) in the bands 14-14.5 GHz, 10-95-12.75 GHz, 17.7 20.2 GHz and 27.5-30 GHz. The total number of groups of FSS assignments in the MIFR as at 20 July 2012, in all the bands listed above, is 32,348 and a break-up of the number of groups recorded with and without the need for application of RR No. **11.41** are shown below:

|  |  |  |
| --- | --- | --- |
| 1. | No. of Groups without application of RR No. **11.41** (coordination complete): | 15,415 |
| 2. | No. of Groups for which RR No. **11.41** has been applied: | 16,933 |
| 2.1 | No. of Groups considered definitive (recorded on or before 20.09.2005): | 9,419 |
| 2.2 | No. of Groups considered definitive (recorded with CR/C on or before 20.09.2005): | 4,916 |
| 2.3 | No. of groups which may not yet be considered definitive: | 2,598 |

It was noted that more than 50% of the assignments for FSS are recorded in the MIFR under RR **11.41** and as a consequence cannot cause interference nor claim protection from interference with respect to networks previously recorded in the MIFR for which agreement has not been obtained. The question was raised as to how an assignment which is recorded with non‑protection could be used to provide the radio link for unmanned aircraft system which is a safety of life and safety of fight application. The focus should therefore be on the 50% of networks that have completed coordination and thus are able to afford protection from harmful interference provided required performance objectives are met. However there is no guarantee that those coordinated assignments would not be subject to interference from future FSS. These assignments are normally to be protected from interference through application of No. **11.42** and **11.42A**.

In addition to these statistics, it was also noted that the Director of the Radiocommunication Bureau provided a clarification to WP 4A and WP 5B ([Document 5B/301](http://www.itu.int/md/R12-WP5B-C-0301/en)) on the status of FSS assignments in the MIFR in the 10.95-30.0 GHz bands. In this document, the Bureau notes that even though more than 50% of the assignments recorded in the MIFR are in application of the provision of Radio Regulations No. **11.41**, the number of harmful interference cases reported to the Bureau, demonstrating clearly the source of interference to be the assignments recorded in application of Radio Regulations No. **11.41** are only a few cases so far. However, it was mentioned that reporting of the existence of interference or lack of reporting of interference does not mean that interference has not or will not occur.

* 1. **Occurrence of interference**

Of the 50% of assignments examined by the Radiocommunication Bureau which are recorded with favourable finding, it was noted that the occurrence of harmful interference is a matter which needs careful consideration to decide whether a FSS link subject to such unpredictable interference could be used to provide radio link for an application having safety of life and safety of flight nature. Annex 3 of WD PDNR ITU-R M.[UAS-CNPC] discusses mitigation techniques to deal with CNPC link impairment and system failures. This annex, among other annexes, has not yet been agreed by ITU-R.

In many areas on the Earth, harmful interference between FSS networks happens on a regular basis, often several times per week in various transponders and frequency bands. This is due to amongst others, hijacking and illegal use of satellite transponders, malfunctioning equipment or mis-pointed antennas, end users exceeding power limits and launch and bringing into use of satellites without the required coordination. Cases of harmful interference are normally sorted out between the satellite operators or countries involved and are very rarely reported to ITU. The ITU databases therefore will provide little information about the actual interference situation.

For amongst these reasons, it would seem likely that harmful interference also for UAS CNPC operation in the FSS bands needs to be expected in many areas of the Earth on a regular basis, just like that for other FSS operation in the bands.

It was noted that interference can occur on FSS links for a variety of reasons, regardless of how the frequency assignments supporting those links are recorded in the MIFR. In the vast majority of cases when interference does occur, satellite operators rapidly contact the suspected source of interference to resolve the issue. It was further noted that given the experience that satellite operators have with such cases, most interference events are resolved quickly; meaning that most interference events are relatively short lived. As such, one of the issues to be considered is whether satellite networks can be operated in such a manner so as to ensure that interference is sufficiently limited in frequency of occurrence and time of duration so as to meet the performance/availability objectives of UAS CNPC links. Annex 3 of WD PDNR ITU-R M.[UAS-CNPC] discusses mitigation techniques to deal with CNPC link impairment and system failures.

* 1. **Conformity of UA with technical characteristics and protection criteria associated with the FSS**

ITU-R Study Groups concerned are currently dealing with two types of typical FSS systems characteristics:

1. Those which are used in standard and traditional commercial FSS; and
2. Those characteristics assumed for UA CNPC application which in certain area are different from those mentioned in a) above.

Using characteristics referred to in b) above could create the regulatory implication to the extent that if they are not within the characteristics of the specific or typical earth station notified FSS network they could require additional coordination. Moreover, even if the conditions mentioned above are met, should the system characteristics be more sensitive than those notified they could be more vulnerable to interference from other satellite networks. Under both of these two circumstances the occurrence of the interference would hamper the reliability and service availability of the unmanned aircraft system.

Currently the ITU-R is studying the required protection criteria for the operation of UAS CNPC using FSS links. However, it is not clear how the FSS links used for CNPC could have different protection criteria than those used in the FSS links employed for this purpose

It was noted that in many cases, the FSS has a nature of operation by a commercial satellite operator. The operation license is issued by a country. Possibly the spacecraft is licensed by a country far away from where the actual operation takes place and different from that of the country licensing the earth stations. Moreover, transmitting and receiving earth stations are often operating in a country without individual licensing or coordination under a class type of license (e.g. VSAT type of networks).

Other issues that may be considered by the ITU-R include the fact that satellite operators are normally not the end user of the services, but will lease capacity to service providers who in turn will sell services to the end users. Those end users could be private entities, broadcaster, government, etc. Normally, these end users will then procure, establish and operate the earth stations accessing the satellite.

* 1. **Views contributed to APG15-4**

The following views were submitted by members at the fourth meeting of APG15.

**View of Thailand**

Thailand supports studies carried out by ITU-R to consider the use of frequency bands allocated to the fixed-satellite service not subject to Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems (UAS) in non-segregated airspaces. Thailand is still considering which Method to support.

Thailand noted that the progress of studies carried out by ITU-R had been slow due to lack of time and/or possible agreement. Lack of thorough study results in time for WRC-15 will prevent Administrations from making justifiable and definitive views and positions required under this agenda item.

Consequently, Thailand is of the view that ITU-R should continue to further develop and complete related studies in time for WRC-15 so that those results can form the basis for Administrations in making the appropriate and concrete proposals to WRC-15. Should there be any different views, they should be expressed in relevant ITU-R reports and Draft CPM Report. Then Administrations will be able to consider all the views expressed and make their own justifiable and definitive views required under this agenda item.

**View of Korea**

The Republic of Korea is of the view that the bands which were not conducted compatibility studies should be excluded from considered frequency bands.

**View of New Zealand**

1. supports Method B (NOC);
2. could support Method A if ITU-R studies, in accordance with Resolution **153** (**WRC-12**), show that the fixed-satellite service (FSS) can demonstrate equivalence to the safety-related services provided under aeronautical mobile-satellite (route) service (AMS(R)S);
3. supports the preparation of ITU regulatory actions, in accordance with Article **11** of the Radio Regulations, to enable use of frequency bands allocated to the FSS for UAS control and non-payload communications (CNPC) links to ensure consistency with ICAO technical and regulatory requirements for a safety service in non-segregated airspaces as well as pursuant to No. **4.10** of the Radio Regulations.

**View of Iran**

I.R. of Iran supports the Method B (NOC) to the ITU’s RR.

Reasons for No Change:

* There are considerable technical, operational and regulatory obstacles for the use of FSS for UAS CNPC links. Moreover, existing allocations for AMS(R)S as well as AMSS and MSS, under certain conditions could satisfy the requirements for UAS CNPC in the frequency bands of these services. It is worth to mention that at the recent interregional information meeting held in Geneva in November 2014, several administrations and satellite operators clearly mentioned the inappropriateness and non-feasibility of the use of uncoordinated, incompletely coordinated commercial FSS which are not granted a safety service for unmanned aircraft which is of very highly safety application.
* Moreover no agreement was reached on the results of studies due to the fact that there is a major divergence of views on the appropriateness, feasibility of the use of the FSS for such a sensitive and delicate issue which is very high degree of importance in terms of safety of flight and satiety of life.

n fact the study is at its very early stage and the activities of the ITU-R are in form of ‘Document toward Preliminary Draft New Report” which is far from being considered to yield an acceptable/agreed (See I.R. of Iran’s contributions for previous WP 5B meetings: [Document 5B/596-E](file:///D:\APT%20Docs\APG\APG2015\APG15-4\Documents\Received\Iran\R12-WP5B-C-0596!!MSW-E.docx) and [Document 5B/595-E](file:///D:\APT%20Docs\APG\APG2015\APG15-4\Documents\Received\Iran\R12-WP5B-C-0595!!MSW-E.docx)). However, no change is also being considered by these Administration acceptable /agreed results.

* This Administration in its contribution 5B/676 indicating that :

***Quote***

“*This Administration maintains its position and is of the strong believes that:*

1. *The introductory text should remain as it is until all questions are answered and all doubts are removed.*
2. *The document, irrespective of its development should NOT BE UPGRADED to a PDNR. Until administrations which have raised concerns ,including this administration have the opportunity to attend the meeting and discuss the matters further with an objective that are divergence views are reconciled.*
3. *The document should continue to be placed in physical bold square bracket until the subsequent meeting of WP 5B in 2015 in which this administration would have the opportunity to attend that meeting and discuss the pending issues in detail with other administrations.”*

***Unquote***

Therefore, the title of the report of the document mentioned below should be as follows:

– Document toward Preliminary draft new Report ITU-R RS.[UAS-FSS] – “Technical and operational characteristics, interference and regulatory environments associated with the use of frequency bands allocated to the fixed satellite service no subject to Appendices 30, 30A, and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspace”

* It is worth to mention that the referenced Resolution in Method **A** (Use of the fixed satellite service) was never ever discussed in any WP 5B Meetings, at all. It was attached to some input documents but due to the major disagreement about the subject matter the Resolution is question was just attached without being discussed. Moreover, the content of the Resolution is totally inappropriate and does not reflect the reality .
* As it is noted, there is a long list of disadvantage of Method **A** (More than 15 items) which indicate a considerable degree of non feasibility and inappropriateness of the use of commercial FSS:

a) 50% of which have not completed the coordination and even have only coordinated with few among many affected administrations.

b) Within the rest of 50% for which blanket coordination has been announced, there is no information on the level of interference that has been accepted.

c) Moreover, even if and only if all coordination’s are completed ,there is no guarantee that the future commercial FSS satellites currently in operation would not cause harmful interference to the above- mentioned link.

d) Occurrence of interference for fraction of minute could create a catastrophic results as tens of unmanned aircraft will be misguided which could collide with other unmanned and or manned aircraft.

Any other method, apart from Method A and Method B, would need to be consistent with Agenda item 1.5.

**View of China**

China does not support the usage of frequency bands allocated to the fixed-satellite service not subject to Appendices **30**, **30A** and **30B** for the UAS CNPC links in non-segregated airspaces, unless the following conditions can be met,

* the safety requirements of UAS is properly addressed;
* the compatibility between UAS CNPC links and incumbent systems in related bands is ensured;
* regulations relating to UAS operation in FSS bands do not impose any adverse impact on existing and future satellite networks of the FSS and other services in the same band.

**View of Australia**

Australia supports measures to allow use of frequency bands allocated to the fixed-satellite service not subject to Appendices **30**, **30A** and **30B** for the control and non-payload communications of unmanned aircraft systems (UAS) in non-segregated airspaces, in accordance with Resolution **153 (WRC-12),** provided technical and regulatory actions identified in ITU-R studies satisfy accepted safety requirements and do not place unacceptable constraints on other applications of the fixed-satellite service.

Australia presently favours Method A of the Draft CPM Report while recognizing the associated draft Resolution to address CPM text regulatory and procedural considerations (Resolution [FSS-UA-CNPC]) needs to be satisfactorily progressed to facilitate use of the FSS for UAS CNPC.

Australia remains open to other Methods that might be developed to satisfy this Agenda item.

Australia notes that correspondence from the BR to ICAO suggests that taking into account that the WRC is the highest decision-making body on international radiocommunications regulations, WRC-15 may approve a provision, via a footnote or Resolution as proposed in Method A in the draft CPM text, which allows UA to communicate with a satellite network in FSS services.

**View of Malaysia**

Malaysia supports **Method A,** provided that the use of frequency bands allocated to the fixed-satellite service (FSS) not subject to Appendices **30**, **30A** and **30B** for the control and non-payload communications (CNPC) of unmanned aircraft systems (UAS) in non-segregated airspaces does not impose constraints on the existing primary services in these frequency band and conform with aviation safety requirement as set by International Civil Aviation Organization (ICAO).

**View of Japan**

Japan is of the view that sufficient studies should be conducted to prevent an adverse impact on the existing services.

**View of Vietnam**

* This Administration supports studies done by ITU-R Working Party 5B on UAS CNPC link within Resolution **153 (WRC-12)**.
* When considering the use of UAS CNPC link in frequency allocated to FSS, the followings should be carefully consider:

+ The Fixed Satellite Service is not a safety service (Rec. 724 (WRC-07))

+ Operation of other aeronautical safety services and UAS itself must be ensured;

+ No constrain is introduced to existing services;

+ Clearly identified of UAS spectrum requirement.

* On the basis of above views, Viet Nam supports Method B (No Change) in the draft CPM report.

**4. APT Preliminary Views:**

* Support ITU-R studies on measures to enable use of frequency bands allocated to the fixed-satellite service not subject to Appendices **30**, **30A** and **30B** for the control and non-payload communications of unmanned aircraft systems (UAS) in non-segregated airspaces, in accordance with Resolution **153 (WRC-12)**.
* The compatibility between UAS CNPC links and incumbent systems in related bands should be ensured.
* Satellite command and control links should comply with accepted safety requirements, including ICAO Standards and Recommended Practices (SARPs) when developed.
* Any regulation relating to UAS operation in FSS bands should prevent an adverse impact on existing and future satellite networks of the FSS and other services in the same band without compromising relevant ICAO Standards and Recommended Practices (SARPs).
* Clear identification of globally harmonized spectrum for UAS CNPC links is preferred so that the current practice of licensing of manned aircraft following the ICAO standards can be extended to unmanned aircraft.
* All studies relating to the supporting Document towards preliminary draft new Report should be duly completed and adopted by ITU-R Study Groups before WRC-15.
* All technical, operational, regulatory issues referred to above should be properly addressed.
* Performance availability and service availability requirements to ensure safety aspects of the UAS CNPC and to conform to the very high degree of reliability required for such operation are yet to be established.

**5. APT Views on the methods proposed to address the Agenda item:**

**View One**

**Supporting Method A**

UAS CNPC links could be supported on the basis that systems operating in the FSS have the capability to provide reliable BLOS communications between unmanned aircraft and control stations, and UAS already operate in segregated airspace using FSS frequency bands for unmanned aircraft to satellite links under No. **4.4** of the Radio Regulations.

Proponents of Method A of the draft CPM text recognise that the associated draft Resolution should address technical, operational, regulatory, procedural and safety aspects of the use of FSS for UAS CNPC and further discussion of this resolution is required at ITU-R (See section 1, Methods to Satisfy the Agenda Item).

To this effect, issues mentioned in section 4 above need to be duly and properly addressed and the Resolution associated with method A should satisfy all conditions and requirements which include but are not limited to those mentioned above.

**View Two**

**Supporting Method B**

No change NOC

*Reasons*

The numerous obstacles, constraints and due to uncertainty in the operational, regulatory and procedural aspects of the FSS as a commercial communication link to be used for an application of highly safety aspects, it is difficult, if not impossible, to state, at this stage, that FSS could be used to provide CNPC application in UAS. Moreover, existing allocations for AMS(R)S as well as AMSS and MSS, under certain conditions would satisfy the requirements for UAS CNPC in the frequency bands of these services.

**Other Possible Methods**

Some APT Members remain open to other Methods that might be developed to satisfy this Agenda item, other APT Members do not support this concept.

**6. Issues for Consideration at APG15-5 Meeting:**

It should be noted that the above views, coming substantially from APG15-3, should be reviewed based on developments of the matter between APG15-3 and APG15-5. APT Members are invited to follow the progress of ITU-R studies, including the outcome of CPM15-2, and encouraged to contribute to these studies to be considered at APG15-5.

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1. 2 In ICAO the UASis referred to as Remotely Piloted Aircraft System (RPAS**)**: to indicate that there is still a pilot responsible for the flight. This was always assumed in ITU when the term UAS was established. [↑](#footnote-ref-1)
2. Control and non-payload communications (CNPC) are referred to in ICAO as Command and Control (C2) or Command, Control and ATC Communications (C3). [↑](#footnote-ref-2)