



# International Civil Aviation Organization

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## FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)

### SECOND MEETING

Montréal, Canada, 15 – 16 September 2016

<h2>REPORT FOLDER</h2>
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*The material in this report has not been considered by the Air Navigation Commission. The views expressed therein should be taken as advice of a panel of experts to the Air Navigation Commission but not as representing the views of the Organization. After the Air Navigation Commission has reviewed this report, a supplement setting forth the action taken by the Air Navigation Commission thereon will be issued to this report.*



## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **SECOND MEETING**

**Headquarters, 15 to 16 September 2016**

### **GENERAL**

The attached constitutes the general part of the report and should be inserted at the appropriate place in the yellow folder.

**SECOND MEETING OF THE  
FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)  
(2016)**

**LETTER OF TRANSMITTAL**

To: President, Air Navigation Commission

From: Chairman, Frequency Spectrum Management Panel  
(FSMP) (2016)

I have the honour to submit the report of the second meeting of the Frequency Spectrum Management Panel (FSMP) which was held in Headquarters, from 15 to 16 September 2016.



Michael Biggs  
Chairman

Montréal, 16 September 2016

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2/1	Submit draft ICAO Position for the ITU WRC-19 to States for a preliminary review
3/1	Amend Job-Card FSMP.004.01
3/2	Amend Job-Card FSMP.005.01
3/3	Consider new proposed Job-Card FSMP.00X.01
3/4	Consider new proposed Job-Card FSMP.00Y.01



## FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)

### SECOND MEETING

**Headquarters, 15 to 16 September 2016**

### HISTORY OF THE MEETING

#### 1. DURATION

1.1 The duration of the second meeting of the Frequency Spectrum Management Panel (FSMP) was two days, 15 and 16 September 2016, immediately following a meeting of FSMP-WG/3 (6 to 14 September 2016). The meeting was opened by Farid Zizi, President of the Air Navigation Commission in the ICAO Headquarters, at 0900 hours on 9 September 2016 (during the meeting of FSMP-WG/3).

#### 2. ATTENDANCE

2.1 The meeting was attended by members and observers nominated by eighteen Contracting States and six international organizations, as well as by advisers and others as shown in the list below:

<b>Members</b>	<b>Advisers</b>	<b>Nominated By</b>
D'AMICO, Eddy		Australia
ESTEVES, Jomar Gaudereto	LIMA, Gustavo Erivan Bezerra	Brazil
TAYLOR, John		Canada
ZHANG, Jia	SUI, Yunfeng ZHANG, Yi	China, (People's Republic of)
FLEURY, Christian		France
BUTSCH, Felix	MEYER, Dominik	Germany
KAPUR, Ajay Kumar		India
ZAPPI, Silvio		Italy
TSUNEAKI, Watanabe	OKOCHI, Hiroshi ONO, Fumie TAKAYAMA, Taichi YONEMOTO, Naruto	Japan
OSINGA, Gerlof		Netherlands
GILO, Charlemagne P.	MATNOG, Romel Y. YOSEF, Turki M. Abed	Philippines Saudi Arabia

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TELE, Cokisa Lisa	TSHIKALAHA, Takalani Raymond	South Africa
METTROP, John	MASRANI, Kamlesh PARRY, Stephen	United Kingdom
BIGGS, Michael	DENNY, Robert KOTLER, Scott LADSON, Damon	United States
SOUGUE, Bissa		ASECNA
ROY, Andrew	BAKER, Greg	ASRI
	KHATCHERIAN, Raffi	EUROCONTROL
PRINGVANICH, Noppadol	TOTTEN, Tim	IATA
	PICHAVANT, Claude DE SOUZA, Luiz Fernando	ICCAIA
VASSILIEV, Nikolai		ITU
<b>Observers</b>		
CHAE, Sungchul		Korea (Republic of)
CALINCIUC, Aurelian Sorinel		Romania
<b>ICAO Secretariat</b>		
JÓNASSON, Loftur		

### 3. OFFICERS AND SECRETARIAT

3.1 Mr. Michael Biggs (United States) and Mr. Andrew Roy (ASRI), elected as Chair and Vice-Chair of the Panel for a duration of three years during the meeting of FSMP/1 (August 2015), acted as Chair and Vice-Chair for the meeting. Mr. Loftur Jónasson, Technical Officer (CNS and Frequency Spectrum, Airport Operations and Interoperability Section) acted as Secretary for the meeting.

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#### 4. AGENDA OF THE MEETING

4.1 The agenda for the meeting shown hereunder was approved by the Air Navigation Commission on 3 May 2016.

1. Opening of the Meeting
2. Development of the draft new ICAO Position for WRC-19 (*Job card FSMP.002.01*)
3. FSMP work programme review, including maintenance of existing job cards and proposal of new job cards
  - 3a) Inclusion of provisions on the use of the 5 GHz band (MLS, AeroMACS, RPAS C2 link)
  - 3b) New provisions to support future aeronautical communications
  - 3c) Improvement of frequency assignment planning criteria (117.975-137 MHz) – Doc 9718, Vol II.
  - 3d) Identification of potential new tasks as a result of WRC-15, including potential requirement to develop ICAO provisions for WAIC and Radio Altimeters
4. Updates to the ICAO Spectrum Strategy and Policy (*Job card FSMP.001.01*)
5. Updates to Doc 9718, Vol II (frequency assignment planning criteria) (*Job card FSMP.005.01*)
6. Coordination with other panels
7. Any other business

#### 5. WORKING ARRANGEMENTS

5.1 The panel met as a single body. Discussions in the main meeting were conducted in English. Working documentation was presented in English only. The report was issued in English.

#### 6. OPENING REMARKS BY THE PRESIDENT OF THE AIR NAVIGATION COMMISSION

6.1 Air Navigation Commission (ANC) President Mr. Farid Zizi addressed the meeting and welcomed participants to Montreal. Mr. Zizi in particular noted that he recognized that spectrum was the hidden enabler of all aviation systems, and that without sufficient access to the frequency spectrum resource aviation would not be able to achieve much. The meeting thanked him for his comments.

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FSMP/2-WP/5  
16/9/16

## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **SECOND MEETING**

**Headquarters, 15 to 16 September 2016**

### **AGENDA ITEM 2**

The attached constitutes the report on Agenda Item 2 and should be inserted at the appropriate place in the yellow folder.



**Agenda Item 2: Development of the draft new ICAO Position for WRC-19**  
*(Job card FSM.002.01)*

2.1 WP/03, presented by the Chairman, included the draft ICAO Position for the International Telecommunication Union (ITU) World Radiocommunication Conference 2019 (WRC-19) as initially developed during the meetings of FSMP-WG/2 (Montreal, 15 – 19 February 2016) and as further modified by FSMP-WG/3 (Montreal, 6 – 14 September 2016).

2.2 The panel unanimously endorsed the draft ICAO Position for WRC-19 as presented and recommends that, pending a successful preliminary review by the ANC, it be sent to States for a three month review before final agreement by ANC and approval by Council in 2017. The Draft Position is contained in the Appendix to the Report on this agenda item.

**Recommendation 2/1 Submit draft ICAO Position for the ITU WRC-19 to States for a preliminary review**

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**DRAFT ICAO POSITION  
FOR THE INTERNATIONAL TELECOMMUNICATION UNION (ITU)  
WORD RADIOCOMMUNICATION CONFERENCE 2019 (WRC-19)**

**SUMMARY**

This paper reviews the agenda for the International Telecommunication Union (ITU) WRC-19, discusses points of aeronautical interest and provides the ICAO Position for these agenda items.

The ICAO Position aims at protecting aeronautical access to appropriately protected spectrum for radiocommunication and radionavigation systems that support current and future safety-of-flight applications. In particular, it stresses that safety considerations require that adequate protection against harmful interference must be ensured.

Support of the ICAO Position by Contracting States is required to ensure that the position is supported at the WRC-19 and that aviation requirements are met.

1. Introduction
2. ICAO and the international regulatory framework
3. Spectrum requirements for international civil aviation
4. Aeronautical aspects on the agenda for WRC-19

**Attachment:**

Agenda for ITU WRC-19

## 1. INTRODUCTION

1.1 The ICAO Position on issues of interest to international civil aviation to be addressed at the 2019 ITU World Radiocommunication Conference (WRC-19) is presented below. The agenda of this Conference is contained in the attachment. The ICAO Position is to be considered in conjunction with sections 7-II and 8 of the *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation, Volume I – ICAO spectrum strategy, policy statements and related information* (Doc 9718, Volume I, Second Edition – [in preparation, 2018]). Doc 9718 is available on <http://www.icao.int/safety/fsmp> (see webpage: Documents).

1.2 ICAO supports the working principle within the ITU, as established during studies for WRC-07, that the compatibility of ICAO standard systems with existing or planned aeronautical systems operating in accordance with international aeronautical Standards will be ensured by ICAO. Compatibility of ICAO standard systems with non-ICAO standard aeronautical systems (or non-aeronautical systems) will be addressed in the ITU.

## 2. ICAO AND THE INTERNATIONAL REGULATORY FRAMEWORK

2.1 ICAO is the specialized agency of the United Nations providing for the international regulatory framework for civil aviation. The *Convention on International Civil Aviation* is an international treaty providing required provisions for the safety of flights over the territories of the 191 ICAO Member States and over the high seas. It includes measures to facilitate air navigation, including International Standards and Recommended Practices commonly referred to as SARPs.

2.2 The ICAO Standards constitute the rule of law through the ICAO Convention and form a regulatory framework for aviation, covering personnel licensing, technical requirements for aircraft operations, airworthiness requirements, aerodromes and systems used for the provision of communications, navigation and surveillance, as well as other technical and operational requirements.

## 3. SPECTRUM REQUIREMENTS FOR INTERNATIONAL CIVIL AVIATION

3.1 Air transport plays a major role in driving sustainable economic and social development in hundreds of nations. Since the mid-1970s, air traffic growth has consistently defied economic recessionary cycles, expanding two-fold once every fifteen years. The Air Transport Action Group estimated that in 2014 air transport directly and indirectly supported the employment of 62.7 million people, contributing over \$2.7 trillion to the global gross domestic product (GDP), and carried over 3.3 billion passengers and 50.4 million tonnes of cargo worth \$6.4 trillion.

3.2 The safety of air operation is dependent on the availability of reliable communication and navigation services. Current and future communication, navigation, and surveillance/air traffic management (CNS/ATM) systems are highly dependent upon the availability of sufficient, suitably protected radio spectrum that can support the high integrity and availability requirements associated with

aeronautical safety systems. Spectrum requirements for current and future aeronautical CNS systems are specified in the ICAO Spectrum Strategy<sup>1</sup>, as addressed by the Twelfth Air Navigation Conference, and as approved by the ICAO Council.

3.3 In support of the safety aspects related to the use of radio frequency spectrum by aviation, **Article 4.10** of the Radio Regulations states, “*ITU Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies.*” In particular, compatibility of aeronautical safety services with co-band or adjacent band aeronautical non-safety services or non-aeronautical services must be considered with extreme care in order to preserve the integrity of the aeronautical safety services.

3.4 The continuous increase in air traffic movements as well as the additional requirement for accommodating new and emerging applications such as unmanned aircraft systems (UAS<sup>2</sup>) is placing increased demand on both the aviation regulatory and air traffic management mechanisms. As a result, the airspace is becoming more complex and the demand for frequency assignments (and consequential spectrum allocations) is increasing. While some of this demand can be met through improved spectral efficiency of existing radio systems in frequency bands currently allocated to aeronautical services, it is inevitable that these frequency bands may need to be increased or additional aviation spectrum allocations may need to be agreed upon to meet this demand.

3.5 The ICAO Position for the ITU WRC-19 was initially developed in 2016 with the assistance of the Frequency Spectrum Management Panel (FSMP) and was reviewed by the Air Navigation Commission at the [TBD] meeting of its [TBD] Session on [TBD]. Following the review by the Commission, it was submitted to ICAO Contracting States and relevant international organizations for comment. After a further review of the ICAO Position in the light of the comments received by the Commission on [TBD], the ICAO Position was reviewed and approved by the ICAO Council on [TBD].

3.6 States and international organizations are requested to make use of the ICAO Position, to the maximum extent possible, in their preparatory activities for the WRC-19 at the national level, in the activities of the regional telecommunication organizations<sup>3</sup> and in the relevant meetings of the ITU.

#### 4. **AERONAUTICAL ASPECTS ON THE AGENDA FOR WRC-19**

*Note 1.— The statement of the ICAO Position on an agenda item is given in a text box at the end of the section addressing the agenda item, after the introductory background material.*

*Note 2.— WRC-19 Agenda Items 1.10 and 9.1 (Issue 9.1.4) are of primary interest to aviation and are included in this position.*

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<sup>1</sup> The ICAO spectrum strategy is included in the ICAO *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation*, Volume I – ICAO spectrum strategy, policy statements and related information (Doc 9718, Volume I).

<sup>2</sup> UAS is referred to in ICAO as remotely piloted aircraft systems (RPAS).

<sup>3</sup> African Telecommunication Union (ATU), Asia-Pacific Telecommunity (APT), European Conference of Postal and Telecommunications Administrations (CEPT), Inter-American Telecommunication Commission (CITEL), Arab Spectrum Management Group (ASMG) and the Regional Commonwealth in the Field of Communications (RCC).

*Note 3.— Aviation should participate in studies regarding WRC-19 Agenda Items 1.7, 1.8, 1.9, 1.11, 1.12, 1.13, 1.14, 1.16, 4, 8, 9.1 (Issue 9.1.3) and 9.1 (Issue 9.1.6), to ensure there is no undue impact. As a result, they are included in this position.*

*Note 4.— No impact on aeronautical services has been identified from WRC-19 Agenda Items 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.15, 2, 3, 5, 6, 7, 9.1 (Issue 9.1.1), 9.1 (Issue 9.1.2), 9.1 (Issue 9.1.5), 9.2 and 9.3 which are therefore not addressed in this position.*

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**WRC-19 Agenda Item 1.7**

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**Agenda Item Title:**

**To study the spectrum needs for telemetry, tracking and command in the space operation service for non-GSO satellites with short duration missions, to assess the suitability of existing allocations to the space operation service and, if necessary, to consider new allocations, in accordance with Resolution 659 (WRC-15).**

**Discussion:**

Requirements have been identified for non-GSO satellites with short duration missions. Studies leading up to WRC-15 determined that those requirements would not necessitate new regulatory regimes, rather they could be addressed as part of the space operation service (SOS). WRC-19 studies will determine if existing SOS allocations are sufficient, and if not, will consider new allocations within the frequency ranges 150.05 – 174 MHz and 400.15 – 420 MHz. Portions of these frequency bands are utilized by aviation for systems operating in the fixed service, for aviation support of maritime search and rescue operations, and for emergency position indicating radio beacons (EPIRBs) which operate in the frequency band 406 – 406.1 MHz which is monitored globally by satellite (COSPAS-SARSAT). Protection of EPIRBs from in-band and adjacent band interference is ensured by several provisions of the ITU Radio Regulations (RR). In this respect, Article 5 allocates the band 406 – 406.1 MHz exclusively to the mobile-satellite service (Earth-to-space) limited to EPIRBs, see RR No. 5.266. Appendix 15 to the RR states that any emission capable of causing harmful interference to distress and safety communications in the band 406 – 406.1 MHz is prohibited, see also RR Nos. 5.267 and 4.22. Resolution 205 (Rev. WRC-15) ensures protection of EPIRBs operating in the band 406 – 406.1 MHz from adjacent band interference by requesting administrations not to make new frequency assignments to the fixed and mobile service stations in the adjacent bands 405.9 – 406.0 MHz and 406.1 – 406.2 MHz.

In addition to concerns about the impact of new frequency allocations on aeronautical systems, aviation is also currently considering proposals by various entities for the use of so called space planes<sup>4</sup> to either act as a relatively cheap re-useable satellite launch vehicle or to carry tourists who wish to experience space travel. It is expected that such vehicles will be the precursor to hypersonic travel that could cut the time taken to travel from Europe to Australia from approximately 24 hours to 90 minutes.

Such vehicles will need access to spectrum to both monitor the flight progress as well as interact with air traffic control for clearance through other traffic to both climb to the cruise altitude as well as to descend into the destination airport. Given that they intended to operate above the Karman line but sub-orbitally any spectrum requirement does not naturally fall under either terrestrial or satellite definitions and hence the spectrum need may well either totally or in part be met under a space operation service allocation. Therefore, ICAO would not want to see any action taken under this agenda item that would preclude the use of SOS allocations for space planes should this service be deemed appropriate for such use.

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<sup>4</sup> A space plane is taken to be an aerospace vehicle that operates as an aircraft in Earth's atmosphere, as well as a spacecraft when in space.

**ICAO Position:**

To oppose consideration of possible allocation to the space operation service in the frequency range 405.9 – 406.2 MHz unless agreed ITU-R studies have proven aviation use of the EPIRBs operating in the frequency band 406 – 406.1 MHz is protected in accordance with Resolution 205 (Rev. WRC-15) and RR No. 5.267.

To oppose any new allocations to the space operations service in other frequency bands/ranges that could impact aviation systems unless agreed ITU-R studies have proven sharing and compatibility with those systems.

To ensure that any change to the regulatory provisions and spectrum allocations resulting from this agenda item do not preclude the use of SOS allocations for space planes if this service is deemed appropriate for such use.

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**WRC-19 Agenda Item 1.8**

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**Agenda Item Title:**

**To consider possible regulatory actions to support global maritime distress safety systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS, in accordance with Resolution 359 (Rev. WRC-15).**

**Discussion:**

Search and rescue aircraft and helicopters are an integral part of the global maritime distress and safety system, providing a rapid search capability that can effect a rescue or direct surface vessels to the scene of the incident. As such, they are fitted with appropriate global maritime distress and safety system radio equipment to facilitate such activities. It is therefore essential to ensure that any change to the regulatory provisions and spectrum allocations resulting from this agenda item do not adversely impact on the capability of search and rescue aircraft to effectively communicate with vessels during disaster relief operations.

In addition, ICAO requires, inter alia, that satellite systems supporting aeronautical satellite safety communications (aeronautical mobile-satellite (route) service), must comply with priority requirements contained in ICAO Standards and Recommended Practices (SARPs)<sup>5</sup>. Therefore, if a system which already carries such communications were to be identified to also carry GMDSS, any resultant changes to the Radio Regulations should not adversely impact that, or other, system's SARPs compliance.

**ICAO Position:**

To ensure that any change to the regulatory provisions and spectrum allocations resulting from this agenda item do not adversely impact on the capability of search and rescue aircraft to effectively communicate with vessels during disaster relief operations.

To ensure that any regulatory provisions in response to this agenda item do not adversely impact SARPs compliance of aeronautical mobile-satellite (route) service satellite systems.

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<sup>5</sup> Annex 10, Volume III, paragraph 4.4.1: "Every aircraft earth station and ground earth station shall be designed to ensure that messages transmitted in accordance with Annex 10, Volume II, 5.1.8, including their order of priority, are not delayed by the transmission and/or reception of other types of messages. If necessary, as a means to comply with the above requirement, message types not defined in Annex 10, Volume II, 5.1.8 shall be terminated even without warning, to allow Annex 10, Volume II, 5.1.8 type messages to be transmitted and received."

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**WRC-19 Agenda Item 1.9**

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**Agenda Item Title:****To consider, based on the results of ITU-R studies:**

- 1.9.1 regulatory actions within the frequency band 156 – 162.05 MHz for autonomous maritime radio devices to protect the GMDSS and automatic identifications system (AIS), in accordance with Resolution 362 (WRC-15);**
- 1.9.2 modifications of the Radio Regulations, including new spectrum allocations to the maritime mobile-satellite service (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125 – 157.4375 MHz and 160.6125 – 162.0375 MHz of Appendix 18, to enable a new VHF data exchange system (VDES) satellite component, while ensuring that this component will not degrade the current terrestrial VDES components, applications specific messages (ASM) and AIS operations and not impose any additional constraints on existing services in these and adjacent frequency bands as stated in *recognizing d) and e)* of Resolution 360 (Rev. WRC-15).**

**Discussion:**

Search and rescue aircraft and helicopters are an integral part of the global maritime distress and safety system, providing a rapid search capability that can effect a rescue or direct surface vessels to the scene of the incident. As such they are fitted with appropriate global maritime distress and safety system radio equipment to facilitate such activities. It is therefore essential to ensure that any change to the regulatory provisions and spectrum allocations resulting from this agenda item do not adversely impact on the capability of search and rescue aircraft to effectively communicate with vessels during disaster relief operations

**ICAO Position:**

<p>To ensure that any change to the regulatory provisions and spectrum allocations resulting from this agenda item do not adversely impact aviation systems, including the capability of search and rescue aircraft to effectively communicate with vessels during disaster relief operations.</p>
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**WRC-19 Agenda Item 1.10**

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**Agenda Item Title:**

**To consider spectrum needs and regulatory provisions for the introduction and use of the global aeronautical distress and safety system (GADSS), in accordance with Resolution 426 (WRC-15).**

**Discussion:**

ICAO, upon the completion of a Special Meeting on Global Flight Tracking of Aircraft in Montreal, May 2014, forged consensus among its Member States and the international air transport industry sector that tracking of flights anywhere in the world was a near-term priority. The meeting concluded that global flight tracking should be pursued as a matter of urgency and, as a result, two groups were formed, an ICAO Ad hoc Working Group on Aircraft Tracking which developed a concept of operations to support future development of a global aeronautical distress and safety system (GADSS), and an industry-led group within the ICAO framework called the Aircraft Tracking Task Force (ATTF) that identified near-term capabilities for normal flight tracking using existing technologies. In combination, those efforts will address issues such as:

- aircraft tracking under normal and abnormal conditions;
- autonomous distress tracking;
- flight data recovery; and
- GADSS procedures and information management.

The GADSS concept, as being developed, describes in an evolutionary manner the execution of actions in the short, medium and long terms with each action resulting in benefits. While the systems needed have yet to be fully defined it is anticipated that there may be a need to change a number of Radio Regulations provisions, for example some of those contained in Chapter VII *Distress and Safety Communications* (Articles 30 to 34) and Chapter VIII *Aeronautical Services* (Articles 35 to 45), in order to facilitate the introduction of such a system. As such an agenda item has been established for WRC-19 that is flexible enough to address any requirement for such changes.

ICAO has an advisory group developing the concept of operations for GADSS. This work is to be completed in 2017 and, as it is further developed, a need may be identified for additional provisions to Article 5, or other articles, in order to address additional radio spectrum requirements or strengthen current provisions.

ICAO will support studies as called for as part of Resolution **426** (WRC-15) to identify the additional/modified regulatory provisions required to support GADSS.

Additional information on the development of the ICAO Global Tracking Initiatives can be found at: <http://www.icao.int/safety/globaltracking/Pages/GADSS-Update.aspx>

**ICAO Position:**

To support studies to identify any regulatory changes required for the implementation of GADSS in accordance with ICAO requirements, and action by WRC-19 to integrate those changes into the Radio Regulations.

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**WRC-19 Agenda Item 1.11**

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**Agenda Item Title:**

**To take necessary actions, as appropriate, to facilitate global or regional harmonized frequency bands to support railway radiocommunication systems between train and trackside within existing mobile service allocations, in accordance with Resolution 236 (WRC-15).**

**Discussion:**

Railway transportation systems are evolving, integrating different technologies in order to facilitate various functions. These can include, for instance, sending commands, operating control and data transmissions between train and trackside systems to meet the needs of a high-speed railway environment. Those functions may not be supported by the current narrowband railway radiocommunication systems so infrastructure investment will be required. As a result, this agenda item looks for studies leading to global or regional harmonized frequency bands, to the extent possible, for the implementation of railway radiocommunication systems between train and trackside within existing mobile-service allocations.

According to the current ITU-R documents existing railway radiocommunication systems between train and trackside (RSTT) operate in portions of several frequency ranges, including 140 – 150 MHz, 330 – 360 MHz, 410 – 420 MHz and 450 – 460 MHz, however this list of the bands may be not exhaustive. Taking into account that the band 328.6 – 335.4 MHz is allocated to the aeronautical radionavigation service on a primary basis limited to ILS glide path and since the aeronautical mobile service is a subset of the mobile service, aviation should monitor this agenda item to ensure protection of aeronautical systems/frequency bands.

**ICAO Position:**

To ensure, on the basis of agreed ITU-R studies, that any regulatory actions within existing mobile-service bands do not impact existing aeronautical systems operating in accordance with the Radio Regulations.

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**WRC-19 Agenda Item 1.12**

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**Agenda Item Title:**

**To consider possible global or regional harmonized frequency bands, to the maximum extent possible, for the implementation of evolving intelligent transport systems (ITS) under existing mobile-service allocations, in accordance with Resolution 237 (WRC-15).**

**Discussion:**

Information and communication technologies can be integrated in a vehicle system to provide intelligent transport systems (ITS) communication applications for the purpose of improving traffic management and assisting safe driving. Future vehicular radiocommunication technologies and ITS broadcast systems are emerging and, while some administrations have harmonized frequency bands for ITS radiocommunication applications, others do not. Recognizing that harmonized spectrum and International Standards would facilitate worldwide deployment of ITS radiocommunications and provide for economies of scale in bringing ITS equipment and services to the public, ITU-R studies will consider possible global or regional harmonized frequency bands for the implementation of evolving ITS under existing mobile-service allocations.

The mobile service frequency bands that are currently being studied or used for ITS communications applications include 5 725 0 – 5 875 MHz (dedicated short range communications) and 57 – 66 GHz (integrated systems for ITS). The frequency range 76 – 81 GHz is also being studied for ITS, however it is for vehicular collision avoidance radars.

Since the aeronautical mobile service is a subset of the mobile service, aviation should monitor this agenda item to ensure protection of aeronautical systems/frequency bands.

**ICAO Position:**

To ensure, on the basis of agreed ITU-R studies, that any regulatory actions within existing mobile-service bands do not impact existing aeronautical systems operating in accordance with the Radio Regulations.

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**WRC-19 Agenda Item 1.13**

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**Agenda Item Title:**

**To consider identification of frequency bands for the future development of international mobile telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238 (WRC-15).**

**Discussion:**

Resolution 238 (WRC-15) identifies a number of frequency bands/ranges between 24.25 and 86 GHz that can be considered under this agenda item to be identified for the terrestrial component of international mobile telecommunication use, namely:

- 24.25 – 27.5 GHz, 37 – 40.5 GHz, 42.5 – 43.5 GHz, 45.5 – 47 GHz, 47.2 – 50.2 GHz, 50.4 – 52.6 GHz, 66 – 76 GHz and 81 – 86 GHz, which have allocations to the mobile service on a primary basis; and
- 31.8 – 33.4 GHz, 40.5 – 42.5 GHz and 47 – 47.2 GHz, which may require additional allocations to the mobile service on a primary basis.

The frequency band 24.25 – 24.65 GHz is used for airport surface detection equipment (ASDE) in some countries. Additionally, the frequency range 31.8 – 33.4 GHz is identified in the “*Handbook on Radio Frequency Spectrum Requirements for Civil Aviation*”<sup>6</sup> as also being used for ASDE. The higher frequency ranges give greater resolution; a factor that is gaining greater importance with the ever increasing density of traffic at airports.

The 31.8 – 33.4 GHz frequency range is also used for embedded systems that generate navigation information and a video image of the external scene and provide them to the pilot. The band offers a good compromise between resolution and atmosphere penetration in bad weather conditions.

The frequency range 76 – 81 GHz is allocated to the radiolocation service on a primary basis in all three ITU regions and is planned to be used for non-safety-critical, advisory applications on the airport surface such as wing-tip radar. According to Resolution 238 (WRC-15) the frequency range 76 – 81 GHz is excluded from consideration for IMT, however, any new identification for the terrestrial component of IMT should ensure adjacent band protection of these aviation applications.

Finally, the frequency bands 43.5 – 47 GHz and 66 – 71 GHz have allocations to the radionavigation and/or radionavigation-satellite services. However no aeronautical systems have currently been identified as operating in those frequency bands.

**ICAO Position:**

To oppose any identification of a frequency band for IMT that could impact aviation systems, within a new or existing allocation to the mobile service in the frequency range 24.25 to 86 GHz, unless agreed ITU-R studies demonstrate no adverse impact to those systems.

<sup>6</sup> Doc 9718, AN/957, Volume I, ICAO spectrum strategy, policy statements and related information, First Edition, 2014.

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**WRC-19 Agenda Item 1.14**

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**Agenda Item Title:**

**To consider, on the basis of ITU-R studies in accordance with Resolution 160 (WRC-15), appropriate regulatory actions for high-altitude platform stations (HAPS), within existing fixed-service allocations.**

**Discussion:**

High altitude platform stations (HAPS) are defined in No. 1.66A of the Radio Regulations as stations located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth. Under this agenda item, the following studies will be conducted:

- a) To review the current RR identifications for HAPS in the bands 6 440 – 6 520 MHz, 6 560 – 6 640 MHz, 27.9 – 28.2 GHz, 31.0 – 31.3 GHz, 47.2 – 47.5 GHz and 47.9 – 48.2 GHz and the related WRC Resolutions with a view to possibly modifying the geographical limitations and conditions of operation of HAPS in these bands;
- b) In order to meet any spectrum needs that could not be satisfied in the frequency bands indicated in bullet a) above, to study the following bands already allocated to the fixed service on a primary basis for possible identification for HAPS:
  - on a global level: 38 – 39.5 GHz; and
  - on a regional level: in Region 2, 21.4 – 22 GHz and 24.25 – 27.5 GHz.

HAPS are designed to deliver various communication services over a wide area without the need for ground infrastructure. For example, administrations that currently use VSATs for the provision of aeronautical communication due to the lack of ground infrastructure may be able to use HAPS as an alternative, possibly cheaper, means of providing that infrastructure. Additionally in the future aviation may wish to incorporate the use of platforms such as HAPS into the global air ground communication network. It is therefore important to ensure that any action taken under this agenda item does not adversely affect the potential use of HAPS for aeronautical purposes in the future.

An additional concern is regarding the platform on which the HAPS resides. Care must be taken that radio links used for the HAPS communications service function do not impact any radio links used for safe operation (e.g. command and control links or see-and-avoid) of those platforms.

**ICAO Position:**

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

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**WRC-19 Agenda Item 1.16**

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**Agenda Item Title:**

**To consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz, and take the appropriate regulatory actions, including additional spectrum allocations to the mobile service, in accordance with Resolution 239 (WRC-15).**

**Discussion:**

This agenda item seeks to identify additional spectrum to facilitate the development of wireless access systems, including radio local area networks (WAS/RLAN) in the frequency bands between 5 150 MHz and 5 925 MHz. A number of aviation systems used for the assurance of safety of flight operate in the three frequency bands identified below. It is essential to ensure that any new allocation to the mobile service, or changes to existing regulations, does not adversely impact the operation of these systems.

**5 150 – 5 250 MHz**

The use of WAS/RLAN in this band is currently limited to indoor systems and in accordance with Resolution 229 (Rev. WRC-12). The intention of the WRC-19 studies is to attempt to show compatibility between incumbent services and outdoor WAS/RLAN systems, using appropriate mitigation measures. From an aviation perspective, the frequency band 5 150 – 5 250 MHz is also allocated worldwide on a primary basis to the aeronautical radionavigation service (ARNS), to the fixed-satellite service (No. 5.447A), and in some countries of Region 1 and in Brazil to the aeronautical mobile service for aeronautical telemetry (No. 5.446C). The frequency band is catalogued in Report ITU-R M.2204 as available for possible use by UAS sense and avoid collision awareness ARNS systems that are designed to operate independently of aircraft collision avoidance systems (ACAS) and are considered to be an autonomous operational safety element for avoidance of other air traffic in the vicinity. The technical and operating standards for airborne sense and avoid systems will be available to support any WRC-19 studies.

The frequency band immediately below 5 150 MHz is allocated to the aeronautical radionavigation service, the aeronautical mobile satellite (R) service and the aeronautical mobile service which is limited to aeronautical telemetry and to the aeronautical mobile (R) service. The latter is intended for broadband airport surface communications (i.e. AeroMACS).

**5 350 – 5 470 MHz**

The intention of the studies is to attempt to allocate the frequency range 5 350 – 5 470 MHz to the mobile service with a view to accommodating WAS/RLAN use.

The frequency range 5 350 – 5 470 MHz is allocated worldwide on a primary basis to the ARNS and used on some aircraft for airborne weather radar. The airborne weather radar is a safety critical instrument assisting pilots in deviating from potential hazardous weather conditions and detecting wind shear and microbursts. Previous studies performed by ITU-R indicated that sharing in the frequency bands 5 350 to 5 470 MHz between WAS/RLAN and certain airborne weather radar types, was not feasible if existing WAS/RLAN mitigation measures limited to the regulatory provisions of Resolution 229 (Rev. WRC-12)

were used. Sharing may only be feasible if additional WAS/RLAN mitigation measures are developed, studied and implemented. In addition, the autonomous UAS sense and avoid system described for the 5 150 – 5 250 MHz band above, is also being designed to be capable of operating in this frequency band.

### **5 850 – 5 925 MHz**

The intention of the studies in this band is to accommodate WAS/RLAN use under the existing primary mobile service allocation in frequency band 5 850 – 5 925 MHz.

**Aeronautical Mobile Telemetry:** RR No. 5.457C allows some countries in Region 2 to use the band 5 925 – 6 700 MHz for aeronautical mobile telemetry for flight testing, however the footnote notes that "any such use does not preclude the use of this band by other mobile service applications or by other services to which this band is allocated on a co-primary basis and does not establish priority in the Radio Regulations". It should be noted that there is a primary mobile allocation in all three regions in the 5 850 – 5 925 MHz band.

**Fixed satellite service (FSS) systems used for aeronautical purposes:** The frequency range 5 850 – 5 925 MHz is used by aeronautical VSAT networks for transmission (E-s) of critical aeronautical and meteorological information.

### **ICAO Position:**

To ensure, on the basis of agreed ITU-R studies, that any new provisions, or changes to existing regulatory provisions, in the frequency bands/ranges 5 150 – 5 250 MHz, 5 350 – 5 470 MHz and 5 850 – 5 925 MHz do not adversely impact aviation systems.

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**WRC-19 Agenda Item 4**


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**Agenda Item Title:**

**In accordance with Resolution 95 (Rev. WRC-07) to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation.**

**ICAO Position:****Resolutions:**

<i>Resolution No.</i>	<i>Title</i>	<i>Action recommended</i>
<b>18</b> (Rev. WRC-15)	Relating to the procedure for identifying and announcing the position of ships and aircraft of States not parties to an armed conflict.	Modify to reflect current aeronautical practice
<b>20</b> (Rev. WRC-03)	Technical cooperation with developing countries in the field of aeronautical telecommunications.	No change
<b>26</b> (Rev. WRC-07)	Footnotes to the Table of Frequency Allocations in Article 5 of the Radio Regulations.	No change
<b>27</b> (Rev. WRC-12)	Use of incorporation by reference in the Radio Regulations.	No change
<b>28</b> (Rev. WRC-15)	Revision of references to the text of ITU-R recommendations incorporated by reference in the Radio Regulations.	No change
<b>63</b> (Rev. WRC-12)	Protection of radiocommunication services against interference caused by radiation from industrial, scientific and medical (ISM) equipment.	No change
<b>76</b> (WRC-00)	Protection of geostationary fixed-satellite service and geostationary broadcasting-satellite service networks from the maximum aggregate equivalent power flux-density produced by multiple non-geostationary fixed-satellite service systems in frequency bands where equivalent power flux-density limits have been adopted.	No change
<b>95</b> (Rev. WRC-07)	General review of the resolutions and recommendations of world administrative radio conferences and world radiocommunication conferences.	No change

<b><i>Resolution No.</i></b>	<b><i>Title</i></b>	<b><i>Action recommended</i></b>
<b>114</b> ( <i>Rev. WRC-15</i> )	Studies on compatibility between new systems of the aeronautical radionavigation service and the fixed-satellite service (Earth-to-space) (limited to feeder links of the non-geostationary mobile-satellite systems in the mobile-satellite service) in the frequency band 5 091 – 5 150 MHz.	No change
<b>140</b> ( <i>Rev. WRC-15</i> )	Measures and studies associated with the equivalent power flux-density (epfd) limits in the band 19.7 – 20.2 GHz.	No change
<b>154</b> ( <i>WRC-15</i> )	Consideration of technical and regulatory actions in order to support existing and future operation of fixed-satellite service earth stations within the band 3 400 – 4 200 MHz, as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region 1.	No change
<b>155</b> ( <i>WRC-15</i> )	Regulatory provisions related to earth stations on board unmanned aircraft which operate with geostationary-satellite networks in the fixed-satellite service in certain frequency bands not subject to a plan of Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces.	Modify as necessary based on the results of on-going/-completed studies.
<b>157</b> ( <i>WRC-15</i> )	Study of technical and operational issues and regulatory provisions for new non-geostationary-satellite orbit systems in the 3 700 – 4 200 MHz, 4 500 – 4 800 MHz, 5 925 – 6 425 MHz and 6 725 – 7 025 MHz frequency bands allocated to the fixed-satellite service.	Modify as necessary based on the results of studies under WRC-19 Agenda Item 9.1, Issue 9.1.3.
<b>160</b> ( <i>WRC-15</i> )	Facilitating access to broadband applications delivered by high-altitude platform stations.	Modify or suppress as necessary based on the results of studies carried out under WRC-19 Agenda Item 1.14.
<b>205</b> ( <i>Rev. WRC-15</i> )	Protection of the systems operating in the mobile satellite service in the band 406 – 406.1 MHz.	No change
<b>207</b> ( <i>Rev. WRC-15</i> )	Measures to address unauthorized use of and interference to frequencies in the bands allocated to the maritime mobile service and to the aeronautical mobile (R) service.	No change
<b>217</b> ( <i>WRC-97</i> )	Implementation of wind profiler radars.	No change

<b><i>Resolution No.</i></b>	<b><i>Title</i></b>	<b><i>Action recommended</i></b>
<b>222</b> ( <i>Rev. WRC-12</i> )	Use of the frequency bands 1 525 – 1 559 MHz and 1 626.5 – 1 660.5 MHz by the mobile-satellite service, and procedures to ensure long-term spectrum access for the aeronautical mobile-satellite (R) service.	No change
<b>225</b> ( <i>Rev. WRC-12</i> )	Use of additional frequency bands for the satellite component of IMT.	No change
<b>239</b> ( <i>WRC-15</i> )	Studies concerning wireless access systems including radio local area networks in the frequency bands between 5 150 MHz and 5 925 MHz.	Modify or suppress as necessary based on the results of studies carried out under WRC-19 Agenda Item 1.16.
<b>339</b> ( <i>Rev. WRC-07</i> )	Coordination of NAVTEX services.	No change
<b>354</b> ( <i>WRC-07</i> )	Distress and safety radiotelephony procedures for 2 182 kHz.	No change
<b>356</b> ( <i>WRC-07</i> )	ITU maritime service information registration.	No change
<b>360</b> ( <i>WRC-15</i> )	Consideration of regulatory provisions and spectrum allocations for enhanced automatic identification system technology applications and for enhanced maritime radiocommunication.	Modify as necessary based on the results of studies carried out under WRC-19 Agenda Item 1.9.1.
<b>361</b> ( <i>WRC-15</i> )	Consideration of regulatory provisions for modernization of the global maritime distress and safety system and related to the implementation of e-navigation.	No change
<b>405</b>	Relating to the use of frequencies of the aeronautical mobile (R) service.	No change
<b>413</b> ( <i>Rev. WRC-12</i> )	Use of the band 108 – 117.975 MHz by aeronautical service.	No change
<b>417</b> ( <i>Rev. WRC-12</i> )	Use of the frequency band 960 – 1 164 MHz by the aeronautical mobile (R) service.	No change
<b>418</b> ( <i>Rev. WRC-15</i> )	Use of the band 5 091 – 5 250 MHz by the aeronautical mobile service for telemetry applications.	No change
<b>422</b> ( <i>WRC-12</i> )	Development of methodology to calculate aeronautical mobile-satellite (R) service spectrum requirements within the frequency bands 1 545 – 1 555 MHz (space-to-Earth) and 1 646.5 – 1 656.5 MHz (Earth-to-space).	Suppress as a result of the approval of Recommendation ITU-R M.2091.
<b>424</b> ( <i>WRC-15</i> )	Use of wireless avionics intra-communications in the frequency band 4 200 – 4 400 MHz.	No change

<i>Resolution No.</i>	<i>Title</i>	<i>Action recommended</i>
<b>426</b> (WRC-15)	Studies on spectrum needs and regulatory provisions for the introduction and use of the global aeronautical distress and safety system.	Modify or suppress as necessary based on the results of studies carried out under WRC-19 Agenda Item 1.10.
<b>525</b> (WRC-15)	Use of the frequency band 1 087.7 – 1 092.3 MHz by the aeronautical mobile-satellite (R) service (Earth-to-space) to facilitate global flight tracking for civil aviation	Modify as necessary to reflect the results of completed studies.
<b>608</b> (Rev. WRC-15)	Use of the frequency band 1 215 – 1 300 MHz by systems of the radionavigation satellite service.	Modify as necessary to reflect the results of completed studies.
<b>609</b> (Rev. WRC-07)	Protection of aeronautical radionavigation systems from the equivalent power flux-density produced by radionavigation satellite service networks and systems in the 1 164 – 1 215 MHz band.	No change
<b>610</b> (WRC-03)	Coordination and bilateral resolution of technical compatibility issues for radionavigation satellite networks and systems in the band 1 164 – 1 300 MHz, 1 559 – 1 610 MHz and 5 010 – 5 030 MHz.	No change
<b>612</b> (Rev. WRC-12)	Use of the radiolocation service between 3 and 50 MHz to support oceanographic radar operations.	No change
<b>659</b> (WRC-15)	Studies to accommodate requirements in the space operation service for non-geostationary satellites with short missions.	Modify or suppress as necessary based on the results of studies carried out under WRC-19 Agenda Item 1.7.
<b>705</b> (Rev. WRC-15)	Mutual protection of radio services operating in the band 70 – 130 kHz.	Modification as necessary to reflect the results of completed studies.
<b>729</b> (Rev. WRC-07)	Use of frequency adaptive systems in the MF and HF bands.	No change
<b>748</b> (Rev. WRC-15)	Compatibility between the aeronautical mobile (R) service and the fixed satellite service (Earth-to-space) in the band 5 091 – 5 150 MHz.	No change

<i>Resolution No.</i>	<i>Title</i>	<i>Action recommended</i>
<b>762</b> (WRC-15)	Application of power flux density criteria to assess the potential for harmful interference under 11.32A for fixed-satellite and broadcasting-satellite service networks in the 6 GHz and 10/11/12/14 GHz bands not subject to a plan.	No change
<b>763</b> (WRC-15)	Stations on board sub-orbital vehicles.	Modify to reflect the results of studies under WRC-15 Agenda Item 9.1 Issue 9.1.4.

**Recommendations:**

<i>Recommendation No.</i>		<i>Action recommended</i>
<b>7</b> (Rev. WRC-97)	Adoption of standard forms for ship station and ship earth station licences and aircraft station and aircraft earth station licences.	No change
<b>9</b>	Relating to the measures to be taken to prevent the operation of broadcasting stations on board ships or aircraft outside national territories.	No change
<b>71</b>	Relating to the standardization of the technical and operational characteristics of radio equipment.	No change
<b>75</b> (WRC-15)	Study on the boundary between the out-of-band and spurious domains of primary radars using magnetrons.	Consider modification and expansion to address the changes necessary to reflect current radar designs.
<b>401</b>	Relating to the efficient use of aeronautical mobile (R) worldwide frequencies.	No change
<b>608</b> (Rev. WRC-07)	Guidelines for consultation meetings established in Resolution <b>609</b> (WRC-03).	No change

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**WRC-19 Agenda Item 8**

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**Agenda Item Title:**

**To consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution 26 (Rev. WRC-07).**

**Discussion:**

Allocations to the aeronautical services are generally made for all ITU regions and normally on an exclusive basis. These principles reflect the global process of standardization within ICAO for the promotion of safety and to support the global interoperability of radiocommunication and radionavigation equipment used in civil aircraft. In some instances, however, footnotes to the ITU Table of Frequency Allocations allocate spectrum in one or more countries to other radio services in addition or alternatively to the aeronautical service to which the same spectrum is allocated in the body of the table.

The use of country footnote allocations to non-aeronautical services in aeronautical bands is generally not recommended by ICAO, on safety grounds, as such use may result in harmful interference to safety services. Furthermore, this practice generally leads to an inefficient use of available spectrum to aeronautical services, particularly when the radio systems sharing the band have differing technical characteristics. It also may result in undesirable (sub-) regional variations with respect to the technical conditions under which the aeronautical allocations can be used. This can have a serious impact on the safety of aviation.

The following footnotes in aeronautical bands should be deleted for safety and efficiency reasons as discussed below:

- a) In the frequency bands used for the ICAO instrument landing system (ILS), (marker beacons 74.8 – 75.2 MHz; localizer 108 – 112 MHz and glide path 328.6 – 335.4 MHz) and the VHF omnidirectional radio range system (VOR); 108 – 117.975 MHz, Nos. **5.181**, **5.197** and **5.259** allow for the introduction of the mobile service on a secondary basis and subject to agreement obtained under No. **9.21** of the Radio Regulations when these bands are no longer required for the aeronautical radionavigation service. The use of both ILS and VOR is expected to continue. In addition, WRC-03, as amended by WRC-07, has introduced No. **5.197A** stipulating that the band 108 – 117.975 MHz is also allocated on a primary basis to the aeronautical mobile (R) service (AM(R)S), limited to systems operating in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution **413 (Rev. WRC-12)**. The use of the band 108 – 112 MHz by the AM(R)S shall be limited to systems composed of ground-based transmitters and associated receivers that provide navigational information in support of air navigation functions in accordance with recognized international aeronautical standards. As a result, access to these bands by the mobile service is not feasible, in particular since no acceptable sharing criteria that secure the protection of aeronautical systems have been established to date. Nos. **5.181**, **5.197** and **5.259** should now be deleted since they do not represent a realistic expectation for an introduction of the mobile service in these bands.

- b) Nos. **5.201** and **5.202** allocate the frequency bands 132 – 136 MHz and 136 – 137 MHz in some States to the aeronautical mobile (off-route) service (AM(OR)S). Since these frequency bands are heavily utilized for ICAO-standard VHF voice and data communications, those allocations should be deleted.
- c) In the frequency band 1 215 – 1 300 MHz, which is used by civil aviation for the provision of radionavigation services through No. **5.331**. Footnote No. **5.330** allocates the band in a number of countries to the fixed and mobile service. Given the receiver sensitivity of aeronautical uses of the frequency band, ICAO does not support the continued inclusion of an additional service through country footnotes. ICAO would therefore urge administrations to remove their name from the No. **5.330**.
- d) In the frequency bands 1 610.6 – 1 613.8 MHz and 1 613.8 – 1 626.5 MHz, which is assigned to the aeronautical radionavigation service, and portions of which are utilized for the aeronautical mobile-satellite (R) service, No. **5.355** allocates the band on a secondary basis to the fixed service in a number of countries. Given that this band is allocated to a safety of life service, ICAO does not support the continued inclusion of an additional service through country footnotes. ICAO would therefore urge administrations to remove their name from the No. **5.355**.
- e) In the frequency bands 1 550 – 1 559 MHz, 1 610 – 1 645.5 MHz and 1 646.5 – 1 660 MHz which are assigned to mobile-satellite services, including in some portions assignment to or use by the aeronautical mobile-satellite (R) service, No. **5.359** also allocates the bands to the fixed service on a primary basis in a number of countries. Given that portions of these bands are utilized by a safety of life service, ICAO does not support the continued use of No. **5.359** country footnote. ICAO would therefore urge administrations to remove their name from the No. **5.359**.
- f) In the frequency band 4 200 – 4 400 MHz, which is reserved for use by airborne radio altimeters and wireless avionics intra-communications (WAIC), No. **5.439** allows the operation of the fixed service on a secondary basis in some countries. Radio altimeters are a critical element in aircraft automatic landing systems and serve as a sensor in ground proximity warning systems. WAIC provides aircraft safety communications between points on an airframe. Interference from the fixed service has the potential to affect the safety of both of these systems. Deletion of this footnote is recommended.

**ICAO Position:**

To support deletion of Nos. **5.181**, **5.197** and **5.259**, as access to the frequency bands 74.8 – 75.2, 108 – 112 and 328.6 – 335.4 MHz by the mobile service is not feasible and could create the potential for harmful interference to important radionavigation systems used by aircraft at final approach and landing as well as systems operating in the aeronautical mobile service operating in the frequency band 108 – 112 MHz.

To support deletion of Nos. **5.201** and **5.202**, as use by the AM(OR)S of the frequency bands 132 – 136 MHz and 136 – 137 MHz in some States may cause harmful interference to aeronautical safety communications.

To support deletion of No. **5.330** as access to the frequency band 1 215 – 1 300 MHz by the fixed and mobile services could potentially cause harmful interference to services used to support aircraft operations.

To support deletion of No. **5.355** as access to the frequency bands 1 610.6 – 1 613.8 and 1 613.8 – 1 626.5 MHz by the fixed services could potentially jeopardize aeronautical use of these frequency bands.

To support deletion of No. **5.359** as access to the frequency bands 1 550 – 1 559 MHz, 1 610 – 1 645.5 MHz and 1 646.5 – 1 660 MHz by the fixed services could potentially jeopardize aeronautical use of those frequency bands.

To support the deletion of No. **5.439** to ensure the protection of the safety critical operation of radio altimeters and WAIC systems in the frequency band 4 200 – 4 400 MHz.

*Note 1.— Administrations indicated in the footnotes mentioned in the ICAO Position above which are urged to remove their country names from these footnotes are as follows:*

- No. 5.181**            *Egypt, Israel and Syrian Arab Republic*
- No. 5.197**            *Syrian Arab Republic*
- No. 5.201**            *Armenia, Azerbaijan, Belarus, Bulgaria, Estonia, the Russian Federation, Georgia, Hungary, Iran (Islamic Republic of), Iraq, Japan, Kazakhstan, Moldova, Mongolia, Mozambique, Uzbekistan, Papua New Guinea, Poland, Kyrgyzstan, Romania, Tajikistan, Turkmenistan and Ukraine*
- No. 5.202**            *Saudi Arabia, Armenia, Azerbaijan, Belarus, Bulgaria, the United Arab Emirates, the Russian Federation, Georgia, Iran (Islamic Republic of), Jordan, Moldova, Oman, Uzbekistan, Poland, the Syrian Arab Republic, Kyrgyzstan, Romania, Tajikistan, Turkmenistan and Ukraine*
- No. 5.259**            *Egypt and Syrian Arab Republic*
- No. 5.330**            *Angola, Bahrain, Bangladesh, Cameroon, Chad, China, Djibouti, Egypt, Eritrea, Ethiopia, Guyana, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Nepal, Oman, Pakistan, the Philippines, Qatar, Saudi Arabia, Somalia, Sudan, South Sudan, the Syrian Arab Republic, Togo, the United Arab Emirates and Yemen*
- No. 5.355**            *Bahrain, Bangladesh, Congo (Rep of the), Djibouti, Egypt, Eritrea, Iraq, Israel, Kuwait, Qatar, Syrian Arab Republic, Somalia, Sudan, South Sudan, Chad, Togo and Yemen*
- No. 5.359**            *Germany, Saudi Arabia, Armenia, Austria, Azerbaijan, Belarus, Benin, Cameroon, the Russian Federation, France, Georgia, Greece, Guinea, Guinea-Bissau, Jordan, Kazakhstan, Kuwait, Lithuania, Mauritania, Uganda, Uzbekistan, Pakistan, Poland, the Syrian Arab Republic, Kyrgyzstan, the Dem. People's Rep. of Korea, Romania, Tajikistan, Tanzania, Tunisia, Turkmenistan and Ukraine*
- No. 5.439**            *Iran (Islamic Republic of)*

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**WRC-19 Agenda Item 9.1**

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**Agenda Item Title:**

**To consider and approve the report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention:**

**On the activities of the Radiocommunication Sector since WRC-15.**

*Note.— The subdivision of Agenda Item 9.1 into issues, such as 9.1.1, 9.1.2, etc. was made at the first session of the Conference Preparatory Meeting for WRC-19 (CPM19-1) and is summarized in the BR Administrative Circular CA/226, 23rd December 2015.*

**Issue 9.1.3:**

**Resolution 157 (WRC-15) – Study of technical and operational issues and regulatory provisions for non-geostationary-satellite orbit systems in the 3 700 – 4 200 MHz, 4 500 – 4 800 MHz, 5 925 – 6 425 MHz and 6 725 – 7 025 MHz frequency bands allocated to the fixed-satellite service.**

**Discussion:**

The frequency bands 3 700 – 4 200 MHz and 5 925 – 6 425 MHz are the main bands for VSAT transmissions used for aeronautical ground-ground communications, and parts are also used for feeder links for aviation satellite communications. In addition, the 3 700 – 4 200 MHz frequency band is adjacent to, and the 4 500 – 4 800 MHz band is near to, the frequency band 4 200 – 4 400 MHz in which radio altimeters and wireless avionics intra-communication (WAIC) systems operate. These systems are critical elements supporting safe operation of the aircraft in all phases of flight including navigation, automated landing and safety communications between points on the airframe. Recent study work in the ITU and ICAO, based on information provided by the manufacturers, has shown in theory that radio altimeters can be susceptible to possible interference from systems operating in nearby frequency bands. It is therefore essential to ensure, through sharing studies, that any new system allowed to operate in an adjacent or nearby frequency band will not exceed the interference criteria laid down in Recommendation ITU-R M.2059 “Operational and technical characteristics and protection criteria of radio altimeters utilizing the band 4 200 – 4 400 MHz.”

**ICAO Position:**

To oppose any new or changes to existing regulatory provisions in Article 21 of the ITU Radio Regulations for the frequency bands 3 700 – 4 200 MHz and 5 925 – 6 425 MHz unless it has been demonstrated through agreed ITU-R studies that there will be no impact from the potential introduction of new non-geostationary-satellites on aviation use in those bands.

To oppose introduction of new non-geostationary-satellites in frequency bands near to the frequency band 4 200 – 4 400 MHz unless aviation use of that band is ensured through agreed ITU-R studies.

**Issue 9.1.4:****Resolution 763 (WRC-15) – Stations on board sub-orbital vehicles****Discussion:**

Space planes or sub-orbital vehicles have been discussed at a conceptual level for some time. However, with the advances in technology, the first re-useable space vehicle that can routinely take off and land on a traditional runway is close to becoming a reality with a number of companies either close to or actually testing vehicles. It is expected that such vehicles will be the precursor to hypersonic travel that could cut the time taken to travel from Europe to Australia from approximately 24 hours to 90 minutes.

The introduction of such vehicles will bring a number of challenges to the spectrum and frequency management communities. With respect to spectrum, a sub-orbital space vehicle will travel at an altitude that takes it beyond 100 km which is generally taken as the boundary between the Earth's atmosphere and space. Hence, stations on board sub-orbital vehicles cannot necessarily be regarded as terrestrial stations. However, since space planes are not envisaged to establish an orbital trajectory, stations on board cannot necessarily be considered as space stations located on a satellite. As a result, it is not clear what radio service(s) would be appropriate. From a frequency management perspective, planning rules for stations on board sub-orbital vehicles need to consider that their field of view is significantly greater than that of an equivalent station on board an aircraft flying at an altitude around 35 000 ft.

Studies are therefore required to establish a common understanding as to how stations on board sub-orbital vehicles should be regarded in radio regulatory terms and whether a new category of service or station needs to be established. Furthermore, studies are needed to determine what spectrum will be required to ensure their safe operation, including their passage through the airspace used by conventional aircraft. Resolution **763 (WRC-15)** calls for such studies, and if the results indicate that additional spectrum and/or other regulatory measures are required, provides for a possible WRC-23 agenda item.

**ICAO Position:**

To support the studies called for by Resolution **763 (WRC-15)** noting that those studies need to be completed during this study cycle.

If the results of studies indicate that additional spectrum and/or other regulatory measures are required, seek an agenda item for WRC-23.

**Issue 9.1.6:****Resolution 958 (WRC-15) – Urgent studies required in preparation for the 2019 World Radiocommunication Conference – Wireless power transmission (WPT) for electric vehicles****Discussion:**

Some preliminary work has been conducted by ITU-R Study Group 1 on wireless power transfer (WPT) and, in particular, the study of the feasibility of WPT in the low and very low frequency ranges with power limits of up to 100 kW for charging electric vehicles. Most work, however, has been conducted by external standards organizations. It is important to note that the new technology has a much broader bandwidth with more complex modulation mechanisms, potentially leaking large amounts of power outside the existing bands being proposed for WPT. As a result, Issue **9.1.6** will need to be monitored to ensure it does not impact aviation systems.

**ICAO Position:**

To ensure that the protection of aeronautical systems is appropriately taken into account during the studies called for in response to Resolution **958 (WRC-15)**.

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**ATTACHMENT****RESOLUTION 1380**

(adopted at the tenth Plenary Meeting of the ITU Council in 2016)

**Place, Dates and Agenda of the World Radiocommunication Conference  
(WRC-19)**

The Council,

*noting*

that Resolution 809 of the World Radiocommunication Conference (Geneva, 2015):

- a) resolved to recommend to the Council that a world radiocommunication conference be held in 2019 for a maximum period of four weeks;
- b) recommended its agenda, and invited the Council to finalize the agenda and arrange for the convening of WRC-19 and to initiate as soon as possible the necessary consultation with Member States,

*resolves*

to convene a World Radiocommunication Conference (WRC-19) in Geneva (Switzerland) from 28 October to 22 November 2019, preceded by the Radiocommunication Assembly from 21 to 25 October 2019, with the following agenda:

1 on the basis of proposals from administrations, taking account of the results of WRC-15 and the Report of the Conference Preparatory Meeting, and with due regard to the requirements of existing and future services in the frequency bands under consideration, to consider and take appropriate action in respect of the following items:

1.1 to consider an allocation of the frequency band 50 – 54 MHz to the amateur service in Region 1, in accordance with Resolution **658 (WRC-15)**;

1.2 to consider in-band power limits for earth stations operating in the mobile-satellite service, meteorological-satellite service and Earth exploration-satellite service in the frequency bands 401 – 403 MHz and 399.9 – 400.05 MHz, in accordance with Resolution **765 (WRC-15)**;

1.3 to consider possible upgrading of the secondary allocation to the meteorological-satellite service (space-to-Earth) to primary status and a possible primary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band 460 – 470 MHz, in accordance with Resolution **766 (WRC-15)**;

1.4 to consider the results of studies in accordance with Resolution **557 (WRC-15)**, and review, and revise if necessary, the limitations mentioned in Annex 7 to Appendix **30 (Rev. WRC-15)**, while ensuring the protection of, and without imposing additional constraints on, assignments in the Plan and

the List and the future development of the broadcasting-satellite service within the Plan, and existing and planned fixed-satellite service networks;

1.5 to consider the use of the frequency bands 17.7 – 19.7 GHz (space-to-Earth) and 27.5 – 29.5 GHz (Earth-to-space) by earth stations in motion communicating with geostationary space stations in the fixed-satellite service and take appropriate action, in accordance with Resolution **158 (WRC-15)**;

1.6 to consider the development of a regulatory framework for non-GSO FSS satellite systems that may operate in the frequency bands 37.5 – 39.5 GHz (space-to-Earth), 39.5 – 42.5 GHz (space-to-Earth), 47.2 – 50.2 GHz (Earth-to-space) and 50.4 – 51.4 GHz (Earth-to-space), in accordance with Resolution **159 (WRC-15)**;

1.7 to study the spectrum needs for telemetry, tracking and command in the space operation service for non-GSO satellites with short duration missions, to assess the suitability of existing allocations to the space operation service and, if necessary, to consider new allocations, in accordance with Resolution **659 (WRC-15)**;

1.8 to consider possible regulatory actions to support global maritime distress safety systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS, in accordance with Resolution **359 (Rev. WRC-15)**;

1.9 to consider, based on the results of ITU-R studies:

1.9.1 regulatory actions within the frequency band 156 – 162.05 MHz for autonomous maritime radio devices to protect the GMDSS and automatic identifications system (AIS), in accordance with Resolution **362 (WRC-15)**;

1.9.2 modifications of the Radio Regulations, including new spectrum allocations to the maritime mobile-satellite service (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125 – 157.4375 MHz and 160.6125 – 162.0375 MHz of Appendix **18**, to enable a new VHF data exchange system (VDES) satellite component, while ensuring that this component will not degrade the current terrestrial VDES components, applications specific messages (ASM) and AIS operations and not impose any additional constraints on existing services in these and adjacent frequency bands as stated in *recognizing d) and e)* of Resolution **360 (Rev. WRC-15)**;

1.10 to consider spectrum needs and regulatory provisions for the introduction and use of the global aeronautical distress and safety system (GADSS), in accordance with Resolution **426 (WRC-15)**;

1.11 to take necessary actions, as appropriate, to facilitate global or regional harmonized frequency bands to support railway radiocommunication systems between train and trackside within existing mobile service allocations, in accordance with Resolution **236 (WRC-15)**;

1.12 to consider possible global or regional harmonized frequency bands, to the maximum extent possible, for the implementation of evolving intelligent transport systems (ITS) under existing mobile-service allocations, in accordance with Resolution **237 (WRC-15)**;

1.13 to consider identification of frequency bands for the future development of international mobile telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution **238 (WRC-15)**;

1.14 to consider, on the basis of ITU-R studies in accordance with Resolution **160 (WRC-15)**, appropriate regulatory actions for high-altitude platform stations (HAPS), within existing fixed-service allocations;

1.15 to consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275 – 450 GHz, in accordance with Resolution **767 (WRC-15)**;

1.16 to consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz, and take the appropriate regulatory actions, including additional spectrum allocations to the mobile service, in accordance with Resolution **239 (WRC-15)**;

2. to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with Resolution **28 (Rev. WRC-15)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in Annex 1 to Resolution **27 (Rev. WRC-12)**;

3. to consider such consequential changes and amendments to the Radio Regulations as may be necessitated by the decisions of the conference;

4. in accordance with Resolution **95 (Rev. WRC-07)**, to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

5. to review, and take appropriate action on, the Report from the Radiocommunication Assembly submitted in accordance with Nos. 135 and 136 of the Convention;

6. to identify those items requiring urgent action by the radiocommunication study groups in preparation for the next world radiocommunication conference;

7. to consider possible changes, and other options, in response to Resolution **86 (Rev. Marrakesh, 2002)** of the Plenipotentiary Conference, an advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution **86 (Rev. WRC-07)**, in order to facilitate rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;

8. to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution **26 (Rev. WRC-07)**;

9. to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention:

9.1 on the activities of the Radiocommunication Sector since WRC-15;

9.2 on any difficulties or inconsistencies encountered in the application of the Radio Regulations<sup>\*</sup>; and

9.3 on action in response to Resolution **80 (Rev. WRC-07)**;

10. 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, in accordance with Article 7 of the Convention.

*instructs the Director of the Radiocommunication Bureau*

to make the necessary arrangements to convene meetings of the Conference Preparatory Meeting and to prepare a report to WRC-19,

*instructs the Secretary-General*

1. to make all the necessary arrangements, in agreement with the Director of the Radiocommunication Bureau, for the convening of the Conference;

2. to communicate this Resolution to international and regional organizations concerned.

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<sup>\*</sup> This agenda item is strictly limited to the Report of the Director on any difficulties or inconsistencies encountered in the application of the Radio Regulations and the comments from administrations.



FSMP/2-WP/5  
16/9/16

## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **SECOND MEETING**

**Headquarters, 15 to 16 September 2016**

### **AGENDA ITEM 3**

The attached constitutes the report on Agenda Item 3 and should be inserted at the appropriate place in the yellow folder.



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**Agenda Item 3:** FSMP work programme review, including maintenance of existing job cards and proposal of new job cards

3.1 Under this agenda item, the Panel reviewed the work programme as a whole through a review of the individual job-cards, as contained in WP/02, developed as output from FSMP-WG/03 (6 – 14 September 2016).

3.2 Minor amendments were proposed to two existing Job-Cards and two new Job Cards were proposed.

3.2.1 The first new Job Card is proposed to ensure interference free operation of Radio Altimeters in the light of increased occupancy of the frequency bands adjacent to 4200 – 4400 MHz and suspected insufficient interference rejection characteristics of some existing Radio Altimeter implementations. The meeting noted that this is not an interoperability issue as traditionally addressed in Annex 10 technical SARPs. Further, the meeting noted that care must be given not to unnecessarily impact existing Radio Altimeter equipage.

3.2.2 The second new Job Card proposes the development of high-level SARPs and guidance material for the design and certification of Wireless Avionics Intra-Communications (WAIC) systems in the 4200 – 4400 MHz Radio Altimeter band. WRC-15 allocated this frequency band to WAIC, however its use is conditional to SARPs being developed. Further, SARPs are necessary to ensure compatibility with Radio Altimeters and WAIC systems on other aircraft. However, the new provisions will not need to address aspects such as the WAIC intra-communications links and WAIC – Radio Altimeter interference immunity on-board the individual aircraft, as this is an implementation issue.

3.3 The Panel makes the following proposals in relation to amendment of existing Job Cards and approval of new Job Cards:

**Recommendation 3/1 Amend Job-Card FSMP.004.01**

That this Job Card be amended as shown in the Appendix to the report on this agenda item. These amendments further clarify the task.

**Recommendation 3/2 Amend Job-Card FSMP.005.01**

That this Job Card be amended as shown in the Appendix to the report on this agenda item. These amendments adjust the delivery dates to reflect realistic expectations. It should be noted that WPE item 629 depends on the progress of the standardization of the L-band Digital Aeronautical communications System (LDACS). Working Group T of the Communications Panel, which is planned to meet 5 – 9 December 2016, is expected to convene this work.

**Recommendation 3/3 Consider new proposed Job-Card FSMP.00X.01**

That this Job Card be adopted as shown in the Appendix to the report on this agenda item. The draft new Job Card proposes the development of SARPs to

establish radio frequency and interference rejection characteristics for radio altimeters.

**Recommendation 3/4 Consider new proposed Job-Card FSMP.00Y.01**

That this Job Card be adopted as shown in the Appendix to the report on this agenda item. This draft new Job Card proposes the development of SARPs to establish high-level guidance for the design and certification of Wireless Avionics Intra-Communications (WAIC) systems in the 4200 – 4400 MHz Radio Altimeter band.

**Appendix**

<b>Title</b>		Address radio frequency interference issues for aviation and the need for action by States, ICAO and international organizations together	<b>Reference:</b>	FSMP.004.01(draft-rev-FSMP-WG/;2)		
<b>Source</b>		FSMP/1 Report				
<b>Problem Statement</b>		Interference, including aeronautical sources, non-aeronautical sources, and malicious interference needs to be addressed. Activities include securing the protection of aeronautical communication, navigation and surveillance systems from the adverse effects of electromagnetic interference and ensuring an operating environment in which the avionics can safely operate without impacts of harmful interference. New interference issues need to be addressed in a timely manner, on a case by case basis, as they appear.				
<b>Specific Details (including impact statements)</b>		In order to ensure safe and efficient aeronautical operations, interference free operation of communication, navigation and surveillance systems and other on-board avionics critical for safety and regularity of flight is required for safe and efficient aeronautical operations				
<b>Expected Benefit</b>		Interference free operation of communication, navigation and surveillance systems and other on-board avionics that are critical for safety and regularity of flight				
<b>Reference Documents</b>		AN-Conf/11, Rec 5/2			<b>Attachments</b>	N
<b>Primary Expert Group:</b>		FSMP				
WPE No.	Document affected	Description of Amendment proposal or Action	Supporting Expert Group	Expected dates:		
				Expert Group	Effective	Applicability
1215	Doc 9718 Vol I (interference and its mitigation)	Increase the awareness of member states concerning interference of various types and possible methods for its resolution		Q4 2019		
1217	Doc 9718 Vol II (assignment planning criteria)					
Initial Issue Date: 2015-10-01		Date approved by ANC: 2015-10-01		Session/Meeting: 200-4		

**Appendix**

Title		Develop and maintain SARPs and guidance material to facilitate frequency management of communication, navigation and surveillance systems	Reference:	FSMP.005.01		
Source		FSMP/1 Report				
Problem Statement		In conjunction with other Panels, develop frequency assignment planning criteria to facilitate efficient and interference free operation of aeronautical communication, navigation and surveillance systems to ensure economical, efficient and safe use of the frequency spectrum resource				
Specific Details (including impact statements)		Frequency assignment planning criteria are required for efficient, safe and interference free use of the resource in light of increasing congestion of the frequency bands.				
Expected Benefit		Efficient and interference free (safe) use of aeronautical frequency spectrum bands.				
Reference Documents		Annex 10, Vol V and Doc 9718 Vol II. Secondary interdependencies: Annex 10 Vol I, III, IV			Attachments	N
Primary Expert Group:		FSMP				
WPE No.	Document affected	Description of Amendment proposal or Action	Supporting Expert Group	Expected dates:		
				Expert Group	Effective	Applicability
629	Annex 10 Vol V (and potentially also Vol's I, III, IV) Doc 9718, Vol II Ed x	New provisions to support future aeronautical radiocommunications. (LDACS WG not yet established)	SP, CP, NSP	Q4 2018 Q4 2019	Q2 2020	Q4 2020
1474	Doc 9718, Vol II, Ed 2	Improve frequency assignment planning criteria for the frequency band 117.975 – 137 MHz (expect improvements in adjacent channel criteria)		Q1 2017 Q4 2018	Q3 2017	
619	Annex 10 Vol V (and potentially also Vol's I, III) Doc 9718, Vol II Ed 3	Decisions made by WRC-12 enable use of portions of the 5030-5150 MHz band by AeroMACS and RPAS C2 terrestrial and satellite, in addition to the existing MLS use of the band. In order to enable safe co-use of the band by these services, appropriate ICAO provisions have to be developed	CP, RPASP	Q4 2018	Q2 2020	Q4 2020
Initial Issue Date: 2015-10-01		Date approved by ANC: 2015-10-01		Session/Meeting: 200-4		

**Appendix**

Title		Develop radio frequency and interference rejection characteristics for radio altimeters		Reference:	FSMP.00X.01	
Source		FSMP/2 Report				
Problem Statement		Recent ITU activities have threatened aeronautical systems operating in the 4200-4400 MHz band by considering the introduction of mobile broadband systems in adjacent frequency bands. Existing ITU-R documentation, and related documentation such as RTCA DO-155 <i>Minimum Performance Standard Airborne Low-Range Radar Altimeters</i> , describe some performance characteristics for radio altimeters, however additional/refined details are necessary to enable a proper assessment of suitable protection requirements for systems operating on adjacent frequency bands. Without standardized frequency and interference performance characteristics, there is no way to specify suitable protection from interference from services operating in adjacent frequency bands. This creates safety risks to flying aircraft operating radio altimeters, especially noting that non-aeronautical systems can now operate at the adjacent frequency bands.				
Specific Details (including impact statements)		Radio frequency interference rejection characteristics and associated standards for radio altimeters are needed to ensure frequency sharing compatibility between aircraft radio altimeters and other aeronautical applications, namely Wireless Avionics Intra-Communications (WAIC), in the same band. Furthermore, out-of-band interference susceptibility and rejection characteristics are also required for protecting the operations of the radio altimeters from harmful interference caused by non-aeronautical systems operating in adjacent frequency bands.				
Expected Benefit		Protection of continued safe operations of radio altimeters from potentially harmful in-band and adjacent band radio frequency interference, and guidance for future radio altimeter design.				
Reference Documents		Annex 10 ARINC 707-7B RTCA DO-155 Minimum Performance Standard Low-Range Radar Altimeters Recommendation ITU-R M.2059 "Operational and technical characteristics and protection criteria of radio altimeters utilizing the band 4 200-4 400 MHz", approved Feb. 2014			Attachments  N	
Primary Expert Group:		[FSMP] [to be determined]				
WPE No.	Document affected	Description of Amendment proposal or Action	Supporting Expert Group	Expected dates:		
				Expert Group	Effective	Applicability
	Annex 10	Technical provisions defining technical aspects relating to radio frequency and interference rejection characteristics of the radio altimeters		Q1 2019 [Depends on WAIC measurement effort]		
Initial Issue Date:		Date approved by ANC:		Session/Meeting:		

**Appendix**

<b>Title</b>		Develop and maintain SARPs and guidance to prevent WAIC / Radio Altimeter interference	<b>Reference:</b>	FSMP.00Y.01			
<b>Source</b>		FSMP/2 Report					
<b>Problem Statement</b>		Establish high-level guidance for the design and certification of Wireless Avionics Intra-Communications (WAIC) systems.					
<b>Specific Details (including impact statements)</b>		<p>World Radiocommunication Conference 2015 (WRC-15) also allocated the frequency band 4 200 - 4 400 MHz to the aeronautical mobile (route) service, exclusively reserved for WAIC, operating in accordance with international aeronautical standards. The associated Resolution <b>424 (WRC-15)</b> requires that the WAIC systems protect the operation of the radio altimeters and operate in accordance with SARPs as contained in Annex 10 to the ICAO Convention.</p> <p>It is thus necessary that the SARPS specifically cover the following elements:</p> <ul style="list-style-type: none"> <li>- Requirement that WAIC systems have to tolerate interference coming from radio altimeters from another aircraft</li> <li>- Requirement that WAIC systems on one aircraft shall not interfere with WAIC systems on other aircraft</li> <li>- Requirement that WAIC systems shall not interfere with radio altimeters on other aircraft<sup>1</sup></li> <li>- Receive mask(s) specifying required adjacent band / out-of-band suppression properties of a WAIC receiver</li> <li>- In-band emission properties of a WAIC transmitter, particularly transmit power levels and channel plan</li> <li>- Transmit mask(s) specifying out-of-band emission properties of a WAIC transmitter</li> </ul> <p>Wherever possible the SARPS should reference MOPS to avoid having to update SARPS if MOPS are updated.</p> <p><sup>1</sup>WAIC system compatibility with radio altimeters on-board the same aircraft will be addressed via aircraft system integration and certification.</p>					
<b>Expected Benefit</b>		Mutual protection criteria ensuring the safe operation and required performance of both WAIC and Radio Altimeters.					
<b>Reference Documents</b>		<p>Final Acts WRC-15, Geneva 2015</p> <p>Report ITU-R M.2283 "Technical characteristics and spectrum requirements of Wireless Avionics Intra-Communications systems to support their safe operation", approved Dec. 2013</p> <p>Recommendation ITU-R M.2059 "Operational and technical characteristics and protection criteria of radio altimeters utilizing the band 4 200-4 400 MHz", approved Feb. 2014</p> <p>Report ITU-R M.2318 "Technical characteristics and protection criteria for Wireless Avionics Intra-Communications systems", approved Nov. 2014</p> <p>Report ITU-R M.2319 "Compatibility analysis between wireless avionics intra-communication systems and systems in the existing services in the frequency band 4 200-4 400 MHz", approved Nov. 2014</p> <p>Recommendation ITU-R M.2067 "Technical characteristics and protection criteria for Wireless Avionics Intra-Communication systems", approved in Nov. 2014</p> <p>Recommendation ITU-R M.2085 "Technical conditions for the use of the aeronautical mobile (R) service in the frequency band 4 200- 4 400 MHz to support wireless avionics intra-communication systems"</p> <p>Minimum Operational Performance Standards (MOPS) for WAIC (to be developed)</p>			<b>Attachments</b>		N
<b>Primary Expert Group:</b>		[FSMP] [to be determined]					
WPE No.	Document affected	Description of Amendment proposal or Action	Supporting Expert Group	Expected dates:			
				Expert Group	Effective	Applicability	
	<a href="#">Annex 10 Vol [III or V]</a>	New provisions for WAIC / Radio Altimeter interoperability	CP, FSMP	Q1 2019			
Initial Issue Date:		Date approved by ANC:	Session/Meeting:				



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## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **SECOND MEETING**

**Headquarters, 15 to 16 September 2016**

### **AGENDA ITEM 4**

The attached constitutes the report on Agenda Item 4 and should be inserted at the appropriate place in the yellow folder.



**Agenda Item 4:** Updates to the ICAO Spectrum Strategy and Policy (*Job card FSMP.001.01*)

4.1 The Panel reviewed WP/04 which contained updates to Doc 9718 Volume I, *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation*, as developed during the meetings of FSMP-WG/2 (Montreal, 15 – 19 February 2016) and FSMP-WG/3 (Montreal, 6 – 14 September 2016). In particular updates to the ICAO Frequency Spectrum Policy (Doc 9718, Vol I, Chapter 7) and the ICAO Frequency Spectrum Strategy (Doc 9718, Vol I, Chapter 8) were reviewed. Note that due to the sensitive state of some of the draft material, access to WP/04 is restricted behind the Portal access.

4.2 The progress made by FSMP WG/2 and WG/3 was noted. It is expected that the Spectrum Policy and Strategy will be finalized in April 2017 for a timely submission to the ANC and Council as supplementary material when performing the final review of the ICAO Position for WRC-19. Members are encouraged to submit material in a timely manner for circulation by email, by end of January.

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FSMP/2-WP/5  
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## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **SECOND MEETING**

**Headquarters, 15 to 16 September 2016**

### **AGENDA ITEM 5**

The attached constitutes the report on Agenda Item 5 and should be inserted at the appropriate place in the yellow folder.



**Agenda Item 5:** Updates to Doc 9718, Vol. II (frequency assignment planning criteria)  
(*Job card FSMP.005.01*)

5.1 No papers were presented under this agenda item. However, it was identified that improvements to the adjacent channel criteria for the 117.975 – 137 MHz band will be forthcoming, enabling more efficient use of the band. In addition, as AeroMACS SARPs are now in the final stage of approval (Communications Panel; CP), it is expected that work on band planning material for the 5 GHz band can commence. Several aeronautical services are expected to share the 5 GHz band, MLS, RPAS C2 link (satellite and terrestrial) and AeroMACS. Similarly, once development of SARPs for LDACS commences within CP (CP WG-T initiates work in December 2016), it is foreseen that frequency assignment planning criteria to facilitate co-existence with other aeronautical services in the DME band will be required.

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## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **SECOND MEETING**

**Headquarters, 15 to 16 September 2016**

### **AGENDA ITEM 6**

The attached constitutes the report on Agenda Item 6 and should be inserted at the appropriate place in the yellow folder.



**Agenda Item 6:** Coordination with other panels

6.1 No input papers were addressed under this agenda item.

6.2 The panel noted the successful and on-going coordination with the Communication Panel (CP), Navigation Systems Panel Spectrum Working Group (NSP-SWG), Surveillance Panel Technical Sub-Group (SP-TSG) and Remotely Piloted Aircraft Systems Panel, as reported in the meeting reports of FSMP-WG/2 and FSMP-WG/3.

6.3 Noting that frequency assignment planning in the 960 – 1164 MHz band is challenging, and in order to progress frequency assignment planning criteria for LDACS in this band, the panel looks forward to liaisons from CP, once the CP WG-T commences their work as foreseen in December 2016.

6.4 The Panel noted its continuing role in the liaison between other Panels and the ITU-R, as per the recent liaison statements to ITU-R WP4A and WP5C initiated by RPASP and endorsed by FSMP-WG/3.

6.5 WRC-19 Agenda Item 1.10 “*To consider spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System (GADSS), in accordance with Resolution 426 (WRC-15)*” provides an unique opportunity for civil aviation to identify and enable in a timely manner any potential Radio Regulatory enablers to facilitate GADSS. In order to make use of this opportunity it is of utmost importance that the Panel be intimately involved in the progress of the development of GADSS.

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## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **SECOND MEETING**

**Headquarters, 15 to 16 September 2016**

### **AGENDA ITEM 7**

The attached constitutes the report on Agenda Item 7 and should be inserted at the appropriate place in the yellow folder.



**Agenda Item 7:** Any other business

7.1 No input papers were addressed under this agenda item.

7.2 The meeting was informed of an ongoing test campaign by NASA to test current Radio Altimeter implementations. Further, the meeting was informed that IATA has searched their database of reports from airlines to identify cases of Radio Altimeter interference. Thus far, 23 cases of suspected Radio Altimeter interference have been identified in the years 2014 and 2015.

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International Civil Aviation Organization

**REPORT**

**14 September  
2016**

## **FREQUENCY SPECTRUM MANAGEMENT PANEL (FSMP)**

### **THIRD MEETING OF THE WORKING GROUP OF FSMP (FSMP-WG/3)**

**Montreal, Canada  
6-14 September, 2016**

## **REPORT**

### **1. Introduction**

1.1 The meeting was opened by Mr Loftur Jonasson from the ICAO Secretariat, Montreal and Mr. Mike Biggs, the Rapporteur of Working Group FSMP (FSMP-WG). Mr. Jonasson acted as the Secretary of the meeting. Following introductions, Mr. Biggs welcomed the group and provided introductory remarks, meeting information and housekeeping details.

1.2 The meeting was held in English. After the opening of the meeting the agenda was approved by the group. The agenda is contained in Appendix A.

1.3 The list of papers submitted for consideration by FSMP-WG is contained in Appendix B. The list of participants is in Appendix C.

1.4 The material in this report is organized by meeting agenda item number, and does not necessarily reflect the order of discussions. The meeting conducted a review of the actions from the last meeting. Actions captured during discussions are shown in Appendix D, together with status of prior-meeting(s) actions.

1.5 Air Navigation Commission (ANC) President Mr. Farid Zizi addressed the meeting and welcomed participants to Montreal. Mr. Zizi in particular noted that he recognized that spectrum was the hidden enabler of all aviation systems, and that without that resource aviation would not be able to achieve much. The meeting thanked him for his comments.

## **2. Agenda Item 2 – Completion of ICAO Position for WRC-19**

2.1 Working Papers 1, 2, 3, 8 and 14 and Information Paper 6 addressed various aspects of the proposed ICAO Position for WRC-19. The papers were all introduced, then merged into a single document which was considered more closely. Appendix E provides the agreed outcome of the discussions.

2.2 One point that was raised during the discussion of WRC-19 agenda item 1.10 on the global aeronautical distress and safety system (GADSS) was that the ICAO GADSS advisory group needed to recognize the WRC-19 schedule. The Secretary noted that they had been informed, but agreed that continued reminders would be useful.

2.3 In addition, regarding WRC-19 agenda item 8 on country footnotes, the Japanese Panel member stated:

- Regarding RR No. 5.201 (132 - 136 MHz): In Japan, this frequency band is also assigned to the Off Route service, for example, the administrative communication, and no adverse effect to the aeronautical safety communication. Japan is comfortable to retain the footnote 5.201.
- Regarding RR No. 5.330 (1 215 – 1 300 MHz): In Japan, this frequency band is also assigned to fixed and mobile services. Also there is no adverse effect to the aeronautical safety communication, Japan is comfortable to retain the footnote 5.330.

## **3. Agenda Item 3 – Updates to the ICAO Frequency Spectrum Policy (Doc 9718 Vol 1, Chapter 7)**

3.1 WPs 3 and 5 and IP07 proposed amendments to Chapter 7, Volume I of the “Handbook on Radio Frequency Spectrum Requirements for Civil Aviation” (Doc 9718). The meeting stepped through all of the proposed modifications and made some additional changes. In addition, areas where further improvement was needed were identified. The meeting was given an action to provide suggested text changes to the FSMP-WG/4 meeting, where the goal will be to have a finalized update of Volume I. To facilitate that effort, the updated document, posted as [FSMP/2 WP/4 \(hyperlink\)](#) in the restricted-access section of the FSMP website, will be used as baseline.

## **4. Agenda Item 4 – Updates to the ICAO Frequency Spectrum Strategy (Doc 9718 Vol I, Chapter 8)**

4.1 WP03 and IP07 provided proposed editorial changes and updates to the ICAO Frequency Spectrum Strategy in many chapters of Doc 9718 Volume I. The meeting stepped through the proposed changes and made some additional revisions. As noted above, the meeting was given an action to provide suggested text changes to the FSMP-WG/4 meeting, where the goal will be to have a finalized update of Volume I. To facilitate that effort, the updated document will be posted as Flimsy 1 in the restricted-access section of the FSMP website.

## **5. Agenda Item 5 – Radio Altimeter and WAIC Issues**

5.1 WP06 contained first thoughts on SARPS material for WAIC, proposing a structure for the different requirements that had been considered in the draft job card. The working paper also proposed several working appendices that would help develop and clarify the SARPS information without necessarily being in the SARPS itself. The meeting supported the structure and the draft material is contained as Appendix F.

5.2 WP18 proposed updates for the FSMP job card to develop SARPS for WAIC. After minor edits to the text to clarify the wording, the job card was approved with an FSMP completion date of Feb 2019. The final version is contained in Appendix G.

5.3 P02 explained some of the operational scenarios being considered in the compatibility studies between WAIC on two different aircraft, and between WAIC on one aircraft and radio altimeters on another aircraft. The presentation was noted and comments from the meeting were solicited by the authors.

5.4 Though there were no specific inputs, the meeting made a final review of the proposed job card for radio altimeter SARPS. The meeting debated whether it was premature to approve the job card given the information available, however in the end agreed the task was important enough that an early start was warranted and would align with the WAIC development work. After additional references were added, the job card was agreed with an FSMP completion date of Feb 2019. The agreed job card is contained in Appendix G.

## **6. Agenda Item 6 – Development of (planned) material for ITU-R Studies**

### **6.1 Fixed Satellite Service for UAS/RPAS**

6.1.1 WP04 was drafted by the ICAO remotely piloted aircraft systems (RPAS) Panel (RPASP) and contained proposed liaisons to ITU-R Working parties 4A and 5B (WP4A and WP5B) regarding information required to support RPAS SARPS development for Ku/Ka band satellite systems. WG2 of the RPASP has an action to draft both operational and technical SARPS for command and control (C2<sup>1</sup>) links for RPAS. The work is split into 2 packages, first the actual requirements, and then the possible technical solutions. There was a discussion on the approach to the ITU-R, and how WP5B was expected to respond given the status of the current ITU-R draft UAS FSS report. The meeting agreed that at minimum the ITU-R response should provide an indication from WP5B and WP4A as to whether they can provide the information requested. It was noted that liaison between WP5B and WP4A may be needed before a final response can be generated which also may impact RPASP schedules. The meeting approved the two liaisons without any changes for sending to WP 4A and WP5B.

### **6.2 GADSS**

6.2.1 A presentation (P04) was provided to the meeting by Mr. Miguel Marin (ICAO) regarding the actions of the ICAO Global Aeronautical Distress and Safety System Advisory Group (GADSS-AG). Of particular interest to the meeting was that GADSS was composed of two types of aircraft tracking (Normal and Distress), and an event-driven capability for data retrieval. In the context of GADSS

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<sup>1</sup> RPAS is the ICAO term for what ITU calls unmanned aircraft systems (UAS). C2 is the ICAO term for what ITU call control and non-payload communications (CNPC).

tracking discussions, tracking supporting aircraft air traffic management surveillance was also discussed. The meeting was also informed on a possible role for Cospas-Sarsat. During discussion there was a concern raised about duplication of functionality across multiple systems, increasing the required spectrum requirements unnecessarily. Version 5.8 of the draft GADSS Concept of Operations is provided in IP08.

6.2.2 During discussion, FSMP was asked for guidance on the type of spectrum which would be required for each of the foreseen GADSS function and the following was agreed by the meeting:

**GADSS Spectrum Guidance\***

<b>Function</b>	<b>Spectrum Category</b>
Normal Tracking	A
Surveillance Tracking	B
Distress Tracking	C
Data Retrieval (not used for real-time functions)	A

A: any type of spectrum properly allocated, on a primary basis, for the function being performed

B: only protected aeronautical safety spectrum can be used.

C: only protected aeronautical safety spectrum, or protected distress spectrum (e.g., 406.1 MHz), can be used

\*This chart is not intended to imply that any new spectrum allocations are necessary to support GADSS.

6.2.3 WP19 was a liaison statement from the ITU-T on Aviation Applications of Cloud Computing for Flight Data Monitoring. The meeting concluded that the FSMP was not the most appropriate ICAO group to answer the questions about technical and operational characteristics (including systems architecture) on Global Flight Tracking, security or monitoring of flight data. It was confirmed that the request was circulated within ICAO, and the meeting agreed to wait for the conclusion of the GADSS-AG effort before deciding on a potential response. This approach will be informally coordinated back to the ITU-T POC via one FSMP member.

6.2.4 WP15 proposed several ITU Radio Regulations (RR) Articles that should be reviewed within ICAO to ensure they reflect current aviation practices. In particular, there was concern that some may limit potential GADSS implementation if not addressed. It was agreed that certain modern aviation systems, or changes to the use of existing systems, may require changes to be considered in the ITU-R. To ensure appropriate consideration, an FSMP action item was created to further develop the work before possibly sending it to other ICAO committees or to the ITU-R. This will also be an agenda item for the next FSMP meeting.

### 6.3 ETSI RED Document

6.3.1 WP09 presented a comparison of the spectral mask derived in accordance with Recommendations ITU-R SM.853, SM.1138 & 1541 for Primary (2700-2900 MHz) and secondary surveillance radar as well as ICAO SARPs for secondary surveillance radar. Several commenters noted that radar performance may

depend on a number of variables that are different from standard communications systems, and therefore there may need to be additional consideration between radar technologies to accurately account for emission performance. There were also several questions on the structuring and intent of the ITU-R SM recommendations, and why multiple recommendations appeared. The meeting concluded that more information was needed, however the effort should be closely monitored.

6.3.2 WP20 presented a draft reply that had been developed by the ICAO surveillance panel (SP) to a liaison statement from ETSI on aeronautical radars and related ICAO provisions. Several edits were made to refine the language, especially the relevant ICAO regulations, and how they would relate to the ITU-R radio regulations. The revised LS was approved and can be found in Appendix H.

6.4 Proposed updates of Recommendation ITU-R SM.1009 and M.1466

6.4.1 IP01 provided information about an initiative by the German administration to revise Recommendation ITU-R SM.1009 “Compatibility between the sound-broadcasting service in the band of about 87-108 MHz and the aeronautical services in the band 108-137 MHz”. After considerable discussion, in particular regarding Annex 2 “Liaison Statement by WP1A to Working Parties 5B and 6A inviting to provide views about the proposed revision until 22<sup>nd</sup> November 2016”, the meeting developed the following material which could form the basis of an ICAO contribution to WP5B.

ICAO notes with interest the Liaison Statement from Working Party 1A (5B/98) regarding a possible revision to Recommendation ITU-R SM.1009 “*Compatibility between the sound-broadcasting service in the band of about 87-108 MHz and the aeronautical services in the band 108-137 MHz*”. While we recognize that SM.1009-1 is fairly old (1995), it was the result of extensive studies including both ICAO and multiple ITU-R Working Parties. While work-intensive, that broad participation ensured that both the aviation and broadcast communities were well represented, and as such, the procedures and methodologies catalogued in that Recommendation have served both communities well. We would expect that any efforts to revise that Recommendation would receive similar level of scrutiny and coordination with relevant organizations.

In addition, ICAO would like to point out that if the broader review should result in revisions to Recommendation, time and budget will be required to allow aviation authorities to develop, validate and implement new channel assignment models to reflect those revisions. These should also be taken into account when determining the acceptance of such a revision, i.e., whether any resultant “higher spectrum efficiency and more flexible spectrum planning” provides a positive cost/benefit analysis.

6.4.2 WP07 reported on a proposal by France at the last ITU Working Party 5B in May 2016 to revise Recommendation ITU-R M.1466. The preliminary draft revision of the recommendation adds technical parameters for a radionavigation radar operating in the frequency band 31.8-33.4 GHz. WP07 proposed that at the next meeting of WP5B the document be upgraded from a preliminary draft revision to a draft revision. The meeting agreed to support the proposal and the Secretary took an action to send a submission to WP5B.

6.4.3 P01 provided a presentation on an enhanced flight vision system (EFVS) currently operating in the frequency band 31.8-33.4 GHz. The system, comprised of a head-up display and an imaging sensor, provides increased accessibility in low visibility conditions to airports without instrument landing system

capability. The Ka band was chosen over the W band (75-110 GHz) for the propagation benefits, and for the higher level of development of the technology due to satellite communications research. During discussion it was suggested that the system be included in the work of the ITU Task Group 5/1 dealing with WRC-19 agenda item 1.13 as that frequency band is being considered by that group for IMT identification.

6.5 Though there was no specific contribution, under this agenda item the meeting also briefly discussed the status of the Report generated last cycle regarding satellite reception of already-transmitted automatic dependent surveillance-broadcast (ADS-B) messages. Resolution 425 (WRC-15) invites the ITU-R “to complete, as a matter of urgency, the studies related to the space station reception of ADS-B in the frequency band 1 087.7-1 092.3 MHz”, so the question was asked whether the meeting thought additional work was required. After discussion, the meeting noted that the studies were mature and agreed that as long as the questions in the working document toward a preliminary draft new report (Annex 19 to 5B/71) were answered, there should be no problem with elevating the document at the next WP5B meeting.

## **7. Agenda Item 7: RF Handbook Volume II (Doc 9718 Vol II), Frequency Assignment Planning**

7.1 No papers were presented on this agenda item.

## **8. Agenda Item 8: 5 GHz Band Planning**

8.1 AeroMACS Status

8.1.1 IP04 detailed the results of AeroMACS testing at NASA facilities in Cleveland, Ohio focusing on mobile applications. RTCA compliance testing was accomplished using prototype Hitachi equipment, including net entry, throughput, quality of service and handover functions. The second set of trials looked at providing aircraft with access to system wide information management (SWIM) data, simulating a landing aircraft entering the network and receiving SWIM data products. Future work will include equipping two airports with AeroMACS and doing trials including interoperability, security, application and end-to-end service delivery.

8.2 Global UAS/RPAS channel plan

8.2.1 WP10 paper discussed the use of the 5 030-5 091 MHz frequency band for RPAS C2 links by both satellites and terrestrial systems. That band is currently allocated to the Aeronautical Radionavigation service, Aeronautical Mobile (Route) Service (AM(R)S) & Aeronautical Mobile Satellite (Route) Service (AMS(R)S). The meeting was informed of the current and the future activities and plans for the development of a satellite system in that frequency band, and the resultant efforts taking place both at EUROCAE WG-73 and the ICAO RPASP WG2. The discussion showed that sharing of the spectrum was possible allowing both systems to co-exist in a given geographical coverage area as well as permitting simultaneous use of both systems by an RPAS equipped with an hybrid radio terminal. The meeting was asked to endorse the spectrum sharing principle and took an action to respond for the next meeting.

8.2.2 WP13 provided information on the work being performed in RTCA SC-228 regarding unmanned aircraft control data links. It was noted that the main focus of the first phase was terrestrial systems, limited to requirements that ensured compatibility not necessarily interoperability. This was due to the fact that for the initial phase they were concentrated on a single ground station controlling a single UAS, and they did not want to constrain link design. Future work of RTCA SC-228 will include satellite systems and networked ground systems.

8.2.3 WP16 noted that ICAO efforts regarding remotely piloted aircraft (RPA) have generally focused on larger aircraft that are expected to routinely share airspace with manned aircraft. However smaller RPA that fly below 1,000ft are attracting significant attention. The paper discussed potential implications of smaller RPA and why the FSMP should take an interest. The meeting was also informed that the terms of reference for the RPASP was limited to certified aircraft, so smaller RPA were outside its mandate. After discussion the meeting agreed that while smaller RPA are certainly a concern, FMSP efforts would be limited until operational requirements are determined; and such requirements would need to come from outside the FSMP.

8.2.4 IPO3 informed the meeting regarding radio propagation measurement made for C-band CNPC channels for UAS. The work was a follow-on to previous efforts as reported to FSMP-WG/1 and FSMP-WG/2. The results will be used to develop comprehensive channel models, and the meeting asked to be kept informed on that effort. In particular, it was pointed out that information on fading characteristics would be very useful for the RTCA SC-228 work discussed in WP10.

## **9. Agenda Item 9: Interference from non-aeronautical sources**

9.1 At FSMP-WG/2 some changes in the Job Card outlining the role of ICAO FSMP in addressing radio frequency interference issues (FSMP.004.001) were made. Those changes were quickly reviewed by the meeting to facilitate FSMP adoption. The draft revision to that Job Card is contained in Appendix G.

9.2 WP12 provided details of recent 5G technology testing in the 3700-4200 MHz band at sites near Austin, Texas airport in the United States. Particular attention was paid to describing the aviation industry's steps taken to ensure protection of radio altimeters during the test which were then carried out without reported interference.

9.3 IPO9 described the impacts of interference to GNSS to flight and ATM operations, using particular recent examples. It also discussed the actions taken by the aviation community to address that important issue.

9.4 IP10 described an ongoing situation in Manila regarding GNSS interference/signal degradation impacts on flight and ATM operations. A large number of incidents have been reported in a particular location in the last couple of months, and the source of the interference was being sought. Based on the information provided, the meeting offered a number of suggestions that may assist in that effort.

10.1 WP11 reported on measurements Aviation Spectrum Resources Inc. (ASRI) is making to support implementation of a new spectrum management software system for VHF channel assignments. The goal of the new system is to minimize congestion as aviation services continue to grow alongside the introduction of CPDLC. To ensure VHF voice, ACARS and VDLM2 can co-exist as efficiently as

possible, testing is being conducted on existing voice radios to identify their Out of Band Emissions (OOBE), Adjacent Channel Rejection (ACR), and Third Order Intercept Point (TOI) beyond existing manufacturing specifications. The paper detailed the process, and full results will be presented at later meetings. During discussion the meeting noted that previous efforts trying to ascertain interference to VHF voice, including recent efforts in Germany related to ground based augmentation system (GBAS) implementation (reference WP1, ICAO NSP, September 2014), had used “listening panels” to determine when interference was unacceptable. As a result, similar approaches should be considered for this work.

10.2 WP17 provided a proposal for a new ITU-R recommendation for the protection criteria for HF Ground Stations from adjacent channel emissions and interference. Current documentation (e.g, ITU RR Appendix 27 and/or ICAO SARPS) does not address such criteria, and that lack caused difficulties during studies related to WRC-15. The new Recommendation would prevent that situation from happening in the future; including potentially for studies of wireless power transfer systems under WRC-19 Issue 9.1.6. The meeting supported the idea of the new Recommendation and provided a number of comments.

10.3 IPO2 provided the report of the recent meeting of the ICAO Navigation Systems Panel (NSP) Spectrum Working Group (SWG) which was held at ICAO Headquarters, in Montreal from 6<sup>th</sup> to 9<sup>th</sup> June 2016. The meeting was focused on the development of mature frequency coordination criteria for the GBAS VHF Data-link (VHF) ensuring consistency with the adjacent channel suppression requirements for GBAS on-board receivers of the RTCA Minimum Operational Performance Standard (MOPS), RTCA DO-253. Another important topic was GNSS Radio Frequency Interference (RFI), in particular the preparation of the GNSS RFI mitigation plan to be included into the ICAO GNSS Manual ICAO Doc 9849. Finally it was pointed out that two of the SSW action items could impact text in the Spectrum Handbook (Doc. 9718). The next meeting of the ICAO NSP Spectrum Working Group will take place in Montreal from the 30<sup>th</sup> November to the 2<sup>nd</sup> December 2016 in conjunction with the 3<sup>rd</sup> meeting of the ICAO Navigation Systems Panel, NSP/3. During discussion the meeting supported the continued close cooperation between the SSW and the FSMP.

10.4 IPO5 provided information on the current situation within the UK with respect to moving the operating frequencies for Program Making and Special Events (PMSE) low power wireless microphones and in-ear monitors (“audio PMSE”) in order to make the 700 MHz frequency band available for mobile data. The UK radio regulator (Ofcom) in consultation with the UK CAA has carried out studies into the technical feasibility of operating audio PMSE in the DME frequency band (960-1164 MHz). As a result of those studies and a consultation exercise they released a statement on new spectrum for audio PMSE in that frequency band. To support that idea, they have introduced a number of “Spectrum Planning Rules” that, if adhered to, would ensure protection of aviation systems in the frequency band within the UK scenario considered. Those Rules include conditions such as PMSE licenses that are time, location, and frequency limited; excluding PMSE assignments in guard bands above 960 MHz, around 1030 and 1090 MHz, and below 1164 MHz; and required minimum geographic separations from secondary surveillance radar (SSR) and wide area multilateration (WAM) ground aeronautical receivers. The specific limits in the Rules were based on some limited testing purportedly using methodologies utilized when considering introduction of the military JTIDS system.

10.4.1 The paper generated considerable discussion in the meeting. Questions raised included:

- Why were the results for X-mode and Y-mode distance measuring equipment (DME) systems not the same as the only difference between the two is pulse spacing?
- Does the set of DME interrogators chosen reflect equipage in other countries, or only in the UK?
- Was a margin allocated to address variations in equipment performance in the presence of interference?
- Would controls (similar to the JTIDS EMC Features) be required for PMSE equipment to ensure it automatically stops transmitting if any of the Spectrum Planning Rules are violated?
- How could PMSE equipment licensed for use in the UK be precluded from use outside the UK?
- Why is support for the use of this band for this function only coming from Ofcom? Websites sponsored by the PMSE community do not seem overly enthusiastic about the choice.
- Regarding required geographic separations, how would the entity assigning the PMSE channel know where the aeronautical receivers are located. This information is not generally available when the receivers are not collocated with the 1030 MHz transmitter (for example WAM sensors).
- Has Ofcom considered the approach used in Australia when they migrated audio PMSE out of the 700 MHz band? They now use a number of bands (see link below), none of which also support aviation safety systems.  
<http://www.acma.gov.au/Industry/Suppliers/Product-supply-and-compliance/Commonly-supplied-equipment/available-spectrum-for-wireless-audio-transmitters>

10.4.2 In the end, the meeting was not supportive of the proposal to use the 960-1 164 MHz band for audio PMSE until and unless all concerns could be addressed. European members were encouraged to attend the CEPT Working Group FM meeting scheduled for 17-21 October, 2016 in Bordeaux, France to ensure aviation concerns are fully addressed, and to support that frequency bands not utilized for aviation safety services be further considered.

## **11. Date of next meeting**

11.1 The next meeting, FSMP-WG/4, including a 2 day spectrum workshop, is tentatively scheduled for [8-10 working days total in mid March to mid April] 2017 in [Bangkok/TBC]. Papers for FSMP-WG/4 are due one week prior to the meeting.  
[Schedule/location to be confirmed by early Nov 2016]

APPENDICES

- Appendix A – Agenda
- Appendix B – List of Working Papers, Information Papers and Flimsies
- Appendix C – List of Participants
- Appendix D – Action Item List
- Appendix E – Draft ICAO Position for WRC-19
- Appendix F - Proposed Modifications to Annex 10 to the Convention on International Civil Aviation to support introduction of WAIC systems
- Appendix G – Draft new/modified FSMP job cards
- Appendix H - Material for proposed ICAO Liaison to ETSI responding to their questions

**APPENDIX A****INTERNATIONAL CIVIL AVIATION ORGANIZATION****THIRD WORKING GROUP MEETING OF THE  
FREQUENCY SPECTRUM MANAGEMENT PANEL  
(FSMP-WG/3)  
(Montreal Canada, 6 – 14 September 2016)****Agenda**

1. Opening and working arrangements
2. Completion of ICAO Position for WRC-19
3. Updates to the ICAO Frequency Spectrum Policy (Doc 9718 Vol I, Chapter 7)
4. Updates to the ICAO Frequency Spectrum Strategy (Doc 9718 Vol I, Chapter 8)
5. Radio Altimeter and WAIC issues
  - Draft Job Cards
6. Development of (planned) material for ITU-R Studies on:
  - a. FSS for UAS
  - b. GADSS
  - c. ETSI RED document
  - d. Proposed updates of Recommendation ITU-R SM.1009 and M.1466
7. RF Handbook Volume II (Doc 9718, Vol. II), Frequency Assignment Planning
  - Further development in preparation for a second edition
8. 5 GHz Band Planning
  - a. AeroMACS status
  - b. Global UAS/RPAS channel plan
9. Interference from non-aeronautical sources
10. Any Other Business

**APPENDIX B****List of Papers****List of Working Papers**

<b>Paper #</b>	<b>Source</b>	<b>Title</b>	<b>Agenda Item</b>
<b>1</b>	M. Biggs	Proposed modifications to Draft ICAO WRC-19 Position	2
<b>2</b>	C. Fleury	Proposed modifications to Draft ICAO WRC-19 Position	2
<b>3</b>	T. Watanabe	Modification to the draft new ICAO Position for WRC-19 as regard to Airport Surveillance Detection Equipment (ASDE Radar) operating in 24.25-24.65 GHz for the Agenda Item 1.13 (WRC-19)	2
<b>4</b>	M. Neale & D. Colin	LIAISONS TO ITU-R WP4A AND ITU-R W5B REGARDING INFORMATION REQUIRED TO SUPPORT RPAS SARPS DEVELOPMENT	6
<b>5</b>	M. Biggs	Proposed Modifications to DOC 9718, Volume I, Chapter 7	3
<b>6</b>	ICCAIA	Draft SARPs for Wireless Avionics Intra-Communications (WAIC)	5
<b>7</b>	C. Fleury	Revision of Recommendation ITU-R M.1466	6
<b>8</b>	J. Mettrop	Proposed Modifications to the Draft ICAO Position for WRC-19	2
<b>9</b>	J. Mettrop	Radar – Spectral Mask	10
<b>10</b>	C. Fleury, N. Van Wambeke, J. Mettrop, A. Munroe	On the sharing of the AMS(R)S allocation in the 5030-5091 MHz frequency band between a satellite and terrestrial system to provide UAS C2	8
<b>11</b>	A. Roy	VHF Radio Performance Testing	10
<b>12</b>	A. Roy	Radio Altimeter Protection at AUS Airport (restricted)	9
<b>13</b>	D. Nellis	RTCA MOPS for UAS CNPC	8
<b>14</b>	J. Taylor	Proposed Modifications to Draft ICAO WRC-19 Position	2
<b>15</b>	J. Mettrop	World Radiocommunication Conference Report of the Director Agenda Item 9.2	6/10
<b>16</b>	J. Mettrop	Spectrum support for RPAS flying below 1000 ft	10
<b>17</b>	A.n Roy & G. Baker	Proposal for new ITU-R Recommendation for HF ground station protection criteria	10
<b>18</b>	ICCAIA	Draft SARPS for WAIC	5
<b>19</b>	Secretary	Liaison statement from ITU-T Study Group 17 on aviation applications of cloud computing for flight data monitoring	6
<b>20</b>	Secretary	Reply Liaison to ETSI	6

**List of Information Papers, Presentations and Flimsies**

<b>Paper #</b>	<b>Source</b>	<b>Topic</b>	<b>Agenda Item</b>
1	F. Butsch	Information about an initiative to revise Recommendation ITU-R SM.1009 - Compatibility between the sound-broadcasting service in the band of about 87-108 MHz and the aeronautical services in the band 108-137 MHz	6
2	F. Butsch	Meeting report ICAO Navigation Systems Panel Spectrum Working Group (6-9 June, 2016)	10
3	NICT	C-band Channel Measurement Campaign using Small Unmanned Aircraft – Experimental measurement of air-to-air channel radio propagation	8
4	R. Kerczewski	Testing of AeroMACS Mobile Applications	8
5	J. Mettrop	Operation of Low Power Programme Making and Special Event wireless Microphones in the Frequency Band 960-1164 MHz	10
6	N. Vassiliev and N. Malaguti	Proposed Amendments to the Draft ICAO Position for WRC-19 (restricted access)	2
7	N. Vassiliev and N. Malaguti	Proposed amendments to the RF Handbook Volume I (restricted access)	3
8	Secretary	Draft version 5.8 of the GADSS Concept of Operations Document (restricted access)	6
9	N. Pringvanich	Harmful Interference to Global Navigation Satellite System (GNSS), its impacts on flight air traffic management operations and actions by the aviation community	9
9	C. Gilo	GPS INTERFERENCE/SIGNAL DEGRADATION IN MANILA, PHILIPPINES AFFECTING RNAV (GNSS) INSTRUMENT APPROACH	9

**PRESENTATIONS**

1	C. Fleury	Update of the ITU-R M.1466 recommendation for EFVS applications	6
2	AVSI	WAIC co-existence scenarios	5
3	N. Van Wambeke	5GHz SatCom solution for RPAS C2 Link	8
4	M. Marin	GADSS Update	6

FLIMSIES			
<b>1</b>	Rapporteur	Combined proposed modifications to Doc 9718	3
<b>2</b>	Rapporteur	Combined proposed modifications to Preliminary Draft ICAO WRC-19 Position	2
<b>3</b>	Rapporteur	Job Card for WAIC	5
<b>4</b>	Rapporteur	Proposed ICAO response to ETSI Liaison	6

**APPENDIX C****Third meeting of the Working Group of the Frequency Spectrum Management Panel (FSMP-WG/3)**

Montreal, Canada, 6 to 14 September 2016

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**APPENDIX D****ACTION ITEM LIST**

Number	Description	Actionee	Due Date	Status
32-3	Review proposed VHF adjacent channel planning criteria contained in WG-F/32 WP11/IP02 in order to allow for a decision on whether to update the Spectrum Handbook.	All	FSMP - WG/3	Still open [WP11 provided information on ongoing test effort]
32-5	Consider the issue of interference to radio altimeters as presented in WG-F/32 WP21. Provide input on issues such as: should ICAO develop altimeter standards? What is the best way for ICAO to raise the visibility of the safety issue? Do high intensity radiated field (HIRF) requirements apply to radio systems, and if so, how?	All	FSMP - WG/3	Still open (see Job Card in Appendix G)
32-6	Poll internal data bases and compile list of reported interference to radio altimeter systems. Include geographic locations of instances. Also present a paper to the RASG-MID/4 meeting on the issue.	IATA	FSMP - WG/3	Still open (reporting form distributed but no responses yet)
32-7	Provide input to J. Mettrop to support the examination of cost savings from removing a generic avionics box (ref. WG-F/32 IP08)	All	FSMP - WG/3	Still open
32-8	Review the proposal to develop a definition of "aviation safety system" and provide draft inputs as appropriate	All	FSMP - WG/3	Still open. Input provided in WG-FSMP/1 Flimsy 1 for Comm systems
01-1	Update Doc 9718, Volume I, Section 9.5 "Special Cases" to include material on VSAT vs IMT.	B. Sougue	FSMP - WG/3	
01-3	Provide examples of wired systems causing interference to aviation wireless systems (reference WF-F/32 WP02 and IP14)	All	FSMP - WG/3	

01-5	Provide notional characteristics for the line-of-sight (LOS) and beyond-LOS (BLOS) RPAS systems to be used to begin investigating adjacent channel compatibility with AeroMACS in 5091-5150 MHz.	A. Munro	FSMP - WG/3	more detail expected from EUROCAE WG73 meeting, 23-25 February
02-1	Compile listing of any civil aviation use of 5 150-5 250 MHz, 5 350-5 470 MHz and/or 5 850-6 425 MHz frequency bands	All	FSMP-WG/3	
02-2	Report on results of radio altimeter interference reporting effort	IATA	FSMP-WG/3	
02-3	Provide draft SARPS material for WAIC	AVSI	FSMP-WG/3	Closed with WP06, see Appendix F
02-4	Research ICAO efforts going on with respect to space planes (“legal committee”)	Secretary	FSMP-WG/3	Still Open
02-5	Provide improvements to the Spectrum Handbook Chapter 7	All	FSMP-WG/3	Closed see AI 03-04
02-6	Develop a timeline for FSMP actions regarding <i>resolves</i> 18 of Resolution <b>155 (WRC-15)</b>	All	FSMP-WG/3	
02-7	Discuss within ICAO the assignment of the Job Cards shown in Appendix G	Secretary	FSMP-WG/3	Closed, no interest.
02-8	Provide comments as necessary on Doc 9925, Manual of the Aeronautical Mobile Satellite (Route) Service, sections dealing with the (INMARSAT) SwiftBroadband service.	All	First week of March 2016	Closed
02-9	Add ITU R M.1903 to the list of reference papers in DOC9718, Page 7-106 “protection of GNSS signals from harmful interference”	Secretary	FSMP-WG/3	In draft update, Closed
02-10	Provide information to J. Mettrop as requested in WP24 to assist in development of a simple example	All	ASAP	
02-11	Develop a simple example outlining the approach for aviation system protection suggested in WP24.	J. Mettrop	FSMP-WG/3	
02-12	Provide inputs on spectrum strategy and vision	All	FSMP-WG/3	Closed, see AI 03-04
03-01	Review ITU Radio Regulations Articles related to aviation and determine if revisions are needed. Reflect changes in next update to ICAO Position, and in Doc 9718.	All	FSMP-WG/4	

03-02	Provide submission to WP5B supporting elevation of the preliminary draft revision of Recommendation ITU-R M.1466 to draft revision.	Secretary	Oct. 2016	
03-03	Provide comment on the spectrum sharing approach between terrestrial and satellite RPAS C2 systems for the 5 030-5 091 MHz as proposed in FSMP-WG/3 WP10.	All	FSMP-WG/4	
03-04	Provide comments/revisions to Spectrum Handbook Volume I for review at FSMP-WG/4. [Goal is to have stable final draft out of FSMP-WG/4]	All	Feb 1, 2017	

**APPENDIX E**

**[This material has been inserted into the Main Report of FSMP/2,  
see the Appendix to Agenda Item 2]**

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**APPENDIX F**

**Proposed Modifications to Annex 10 to the Convention on International Civil Aviation**

Insert new text as follows

**CHAPTER xx. WIRELESS AVIONICS INTRA-COMMUNICATIONS (WAIC)**

**xx.1 DEFINITIONS**

**Wireless Avionics Intra-Communications (WAIC).** – WAIC is defined as radiocommunication between two or more aircraft stations located on a single aircraft; supporting the safe operation of the aircraft.

**WAIC Node.** A WAIC node wirelessly transmits and receives application data. It operates under the AM(R)S allocation within the frequency band 4 200 – 4 400 MHz.

**WAIC Gateway.** A WAIC gateway wirelessly transmits and receives application data and provides one or more additional interfaces for connecting to wired aircraft data communication networks.

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<p><b>Origin:</b>  FSMP</p>	<p><b>Rationale:</b>  The above definitions are specific to WAIC and are provided in addition to the general definitions given in Chapter 1, Part 1 of Annex 10 Volume III.</p>
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**xx.2 INTRODUCTION**

xx.2.1 WAIC provides data networking capabilities to aircraft systems related to the safety and regularity of flight.

**xx.3 GENERAL**

xx.3.1 WAIC shall conform to the requirements of this and the following chapters.

xx.3.2 WAIC systems shall comply with the applicable provisions of the ITU Radio Regulations.

xx.3.3 WAIC shall only be used for communications between two or more points on a single aircraft.

xx.3.4 WAIC systems shall coexist with other WAIC systems on other aircraft in mutual radio range.

xx.3.5 WAIC systems shall not cause harmful interference to radio altimeter systems while in operation in the frequency band 4 200 – 4 400 MHz and in mutual radio range.

xx.3.6 WAIC systems shall tolerate interference from radio altimeters in the frequency band 4 200 – 4 400 MHz in mutual radio range.

<b>Origin:</b>	<b>Rationale:</b>
FSMP	The sections above describe the basic function and purpose of WAIC.

**xx.4 RADIO FREQUENCY (RF) CHARACTERISTICS**

xx.4.1 **Frequency Band:** WAIC systems shall operate in the frequency band 4 200 – 4 400 MHz.

xx.4.2 **Radiated Power:** the maximum equivalent isotropically radiated power spectral density of a WAIC transmitter shall not exceed 6 dBm/MHz.

xx.4.3 **In-band Emissions:** WAIC systems shall implement transmitters with spectral in-band emission properties as specified in Table TBD.

xx.4.4 **Out-of-Band Emissions:** Each WAIC transmitter shall limit its out-of-band emissions to TBD dBm measured in any 100 kHz bandwidth.

xx.4.5 **Out-of-Band Rejection:** WAIC systems shall implement receivers that tolerate emissions from emitters outside the 4 200 – 4 400 MHz band of no more than TBD dBm measured at the band edge and at the output of the band protection filter. The WAIC band protection filter shall have an out-of-band rejection roll-off of at least 20 dB/decade starting at the band edges up to TBD dB of attenuation.

<b>Origin:</b>	<b>Rationale:</b>
FSMP	The sections above describe the minimum RF characteristics of WAIC transmitter and receiver.

**xx.5 PERFORMANCE REQUIREMENTS**

xx.5.1 WAIC systems shall maintain their intended performance while subject to emissions from radio altimeters located on the same aircraft.

xx.5.2 WAIC systems located on board one aircraft shall maintain their intended performance while subject to emissions from radio altimeters located on board other aircraft in mutual radio range.

- xx.5.3 WAIC systems located on board one aircraft shall maintain their intended performance while subject to emissions from WAIC systems located on board other aircraft in mutual radio range.
- xx.5.4 WAIC systems shall be designed such that all WAIC systems in an environment that is shared by multiple aircraft are able to meet their intended performance.

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**Appendix A – Worst-case shared radio environments used for coexistence considerations**

TBD

*Editor's Note: Description of the worst-case interference geometries (e.g. number and placement of victim aircraft versus interfering aircraft, different operational scenarios, etc.)*

**Appendix B – Aggregate interference environment for WAIC-equipped aircraft**

TBD

*Editor's Note: Description of the aggregated effect of all interference sources based on representative radio altimeter and WAIC system models.*

**Appendix C – Radio altimeter operations in the presence of WAIC signals**

TBD

*Editor's Note: Demonstration that radio altimeters maintain safe operation in the presence of WAIC signals using simulations and test data.*

## **APPENDIX G**

Draft new/modified FSMP job cards

**[This material has been inserted into the Main Report of FSMP/2,  
see the Appendix to Agenda Item 3]**

**APPENDIX H**

Material for proposed ICAO Liaison to ETSI responding to their questions

**1.1** *That the ETSI radar sub-group is correct in assuming that there are no regulatory provisions within ICAO relevant to the definition of transmit and receive parameters for primary radar?*

**ICAO response:**

ICAO Standards and Recommended Practices (SARPS) are designed to maintain interoperability such that equipment on an aircraft from one country can communicate with similar equipment in another country. Such interoperability is not required for primary radar functions, and as a result ICAO doesn't maintain equipment requirements in the SARPs for primary radar. ICAO does, however, maintain guidance materials, such as ICAO Doc 9924, Aeronautical Surveillance Manual, and ICAO Doc 9718, Handbook on Radio Frequency Spectrum Requirements for Civil Aviation. In addition, while various radars have differing design requirements based on their operational applications, parameters for aeronautical radars are contained in a number of ITU-R Recommendations.

**1.2** *That the transmitter parameters for Mode A/C transmitters are contained in section 3.1.1 whilst those for Mode S are contained in Section 3.1.2 of Volume IV of Annex 10?*

**ICAO response:**

Yes, those are the appropriate sections of the SARPs for the secondary surveillance radar (SSR) and transponder.

**1.3** *The reason as to why the frequency tolerance defined by ICAO for 1090 MHz transponder (3MHz Mode A/C & 1 MHz Mode S) is different to that required by the ITU Radio Regulatory requirements (500 parts in 10<sup>6</sup> or 545 kHz) and whether there are any plans to update these requirements?*

**ICAO response:**

Appendix 2 of Volume II of the ITU RRs does, indeed, indicate a maximum tolerance of 500 parts per million for radiodetermination systems operating in the frequency range used by civil aviation secondary surveillance radar (SSR) systems. This could appear to indicate differences in the frequency tolerance defined by ICAO and ITU; however it is apparent that there are differences within ITU-R as well for SSR systems. Recommendation ITU-R SM.1045-1 Note 9 indicates that the 1090 MHz transponder

may operate within a 3 MHz frequency tolerance, the ICAO SARPs Mode A/C transponder tolerance.

RR No. 35.1 of the ITU RRs indicates that the ICAO SARPs is an intergovernmental agreement that governs the use of aeronautical services, provided that the implementation doesn't cause harmful interference to other countries. The frequency band that the Mode S interrogator (1030 MHz) and transponder (1090 MHz) operate in only contains aeronautical services and the use of these services by international civil aviation is harmonized by ICAO.

ICAO develops aeronautical standards in an international, consensus-based process. Any change in ICAO standards would be an ICAO-led effort following that same approach.

ICAO recommends that the frequency tolerance defined in the ICAO SARPs should be considered the international standard for civil aviation SSR systems.

**1.4 *The reason as to why the spectral masks defined by ICAO within Volume IV of Annex 10 for the Mode S Interrogator (Figure 3-2) and Transponder (Figure 3-5) are such that they would appear not to conform with the ITU Radio Regulatory requirements and whether there are any plans to update these requirements?***

**ICAO Response:**

References to the SARPs are provided, but it's not clear to which ITU RR they are being compared to make the determination of non-conformity. In order to properly evaluate the need for changes to the SARPs, please provide additional information, such as which RRs appear to be different than those defined in the SARPs. ICAO will then be able to evaluate any difference and any potential need to update the SARPs.

ICAO is of the view that this evaluation should also take into consideration RR No. 35.1, as pointed to in the last question. In addition numerous references in ITU (e.g., Resolution **417 (Rev. WRC-15)**) recognize ICAO Annex 10 as the international standards document used by civil aviation.

**1.5 *In the context of aircraft fitted devices, is there any other information that the ETSI Radar sub-group should take into account when preparing the European Harmonised Standards for secondary radars?***

**ICAO Response:**

The following list contains the EUROCAE avionics standards for air traffic control radar beacon systems (ATCRBS), Mode S, automatic dependent surveillance-broadcast (ADS-B), and traffic alert and collision avoidance system (TCAS).

- Light Aviation Secondary Surveillance Radar Transponders minimum operational performance standards (MOPS): Ed-115
- Mode S transponder MOPS: ED-73E
- 1090 ADS-B MOPS: ED-102A
- TCAS MOPS: ED-143

**1.6** *If in answer to question 1, ICAO does define transmit and receive parameters for primary radars:*

- a. Do you have any comments on the information contained in the liaison statement attached to the ITU?*
- b. Is there any other information that the ETSI Radar sub-group should take into account when preparing the European Standards for primary radars?*

**ICAO Response:**

ICAO doesn't define equipment specifications for primary radar.

— END —