

## AGENDA ITEM 1.17

*1.17 to consider possible spectrum requirements and regulatory actions, including appropriate aeronautical allocations, to support wireless avionics intra-communications (WAIC), in accordance with Resolution 423 (WRC-12);*

**Resolution 423 (WRC-12):** *Consideration of regulatory actions, including allocations, to support Wireless Avionics Intra-Communications*

### **3/1.17/1 Executive summary**

The 2012 World Radiocommunication Conference (WRC-12) approved agenda item 1.17 to conduct sharing and compatibility studies to determine appropriate frequency bands for wireless avionics intra-communications (WAIC) systems. According to Resolution 423 (WRC-12) the frequency bands to be initially reviewed are limited to those frequency bands containing allocations to the aeronautical mobile (R) service (AM(R)S), aeronautical mobile service (AMS) and aeronautical radionavigation service (ARNS) below 15.7 GHz. In addition, frequency bands above 15.7 GHz can be studied if spectrum requirements cannot be met in frequency bands allocated to the aeronautical services below 15.7 GHz.

Agenda item 1.17 considers the spectrum requirements and regulatory actions to support WAIC systems. WAIC systems are described in Report ITU-R M.2283. WAIC systems utilize radio communications between two or more stations on board a single aircraft supporting the safe operation of the aircraft. The Report concludes that 145 MHz of radio-frequency spectrum is necessary to support the requirements for WAIC systems.

In accordance with Resolution 423 (WRC-12), an initial assessment was conducted that analyses potential compatibility between proposed WAIC systems and systems operating under an allocation to an incumbent service. It considers all aeronautical bands in the frequency range 960 MHz-15.7 GHz containing either an aeronautical mobile (R) service, aeronautical mobile service, or an aeronautical radionavigation service allocation.

Studies were conducted analysing potential compatibility between proposed WAIC systems and systems operating under an allocation to an incumbent service in the frequency bands 2 700-2 900 MHz, 4 200-4 400 MHz, 5 350-5 460 MHz, 22.5-22.55 GHz, and 23.55-23.6 GHz. Of the frequency bands studied, only the frequency band 4 200-4 400 MHz shows that sharing is feasible.

One method to address the agenda item is proposed. The method adds a new allocation to the aeronautical mobile (R) service reserved exclusively for WAIC systems in the frequency band 4 200-4 400 MHz with an accompanying Resolution.

### **3/1.17/2 Background**

The civil aviation industry is continually developing future generations of aircraft. Each subsequent generation is designed to enhance efficiency and reliability while maintaining current required levels of safety. WAIC systems will offer aircraft designers and operators opportunities to improve flight safety and operational efficiency with the goal of reducing costs to airlines and passengers. WAIC systems could improve an aircraft's performance over its lifetime through more cost-effective flight operations, reduction in maintenance costs, enhancement of aircraft systems that maintain or increase the level of safety, and environmental benefits. WAIC systems are also envisioned to provide new functionalities to aircraft manufacturers and operators.

Manufacturers are provided additional installation options for previously wired systems, while operators are afforded more opportunities to monitor aircraft systems. A major WAIC system

application is wireless sensing. It is expected that existing and future aircraft will be equipped with such wireless sensors. These sensors could be located throughout the aircraft and will be used to monitor the health of the aircraft structure and its critical systems, and to communicate this information. WAIC systems are also intended to support data, voice and safety-related video surveillance applications such as taxiing cameras and may also include communication systems used by the crew for safe operation of the aircraft. WAIC systems can provide additional opportunities to monitor more components and systems without significantly increasing the aircraft's weight.

WAIC systems will only be used for safety-related aircraft applications, providing communications within a single aircraft. While WAIC system transmissions may not be limited to the interior of the aircraft structure, they will not provide communications between an aircraft and the ground, another aircraft or satellite. Because WAIC systems carry aeronautical safety related content they are classified as an application of the aeronautical mobile (R) service.

The total radio-frequency spectrum required for all types of WAIC application categories is 145 MHz. To reflect the diverging conditions and requirements, different categories of WAIC systems are defined. These are based on the two criteria "data rate requirements" and "transmit antenna location on the aircraft", i.e. internal or external to the aircraft structure. For determining bandwidth requirements, low rate and high rate systems are separately considered due to differing technical requirements and technological restrictions their implementation may face.

Given the fact that both radio altimeter and WAIC systems are aeronautical applications and are also regulated by aviation certification authorities as well as ICAO, additional efforts, including development of standards and certification guidance material within the aviation community would contribute in ensuring the safe operation of WAIC and radio altimeter systems.

Further information on WAIC system technical and operational characteristics can be found in the Report ITU-R M.2283.

### **3/1.17/3 Summary of technical and operational studies, including a list of relevant ITU-R Recommendations**

Existing relevant ITU-R Recommendations:

Recommendation ITU-R P.[525](#)-2.

Recommendation ITU-R M.[2059](#).

Existing relevant ITU-R Reports:

Report ITU-R M.[2283](#).

New relevant ITU-R Recommendations:

Recommendation ITU-R M.[2067](#);

PDN Recommendation ITU-R M.[WAIC CONDITIONS].

New relevant ITU-R Reports:

Report ITU-R M.[2319](#);

Report ITU-R M.[2318](#);

### **3/1.17/4 Analysis of the results of studies**

#### **3/1.17/4.1 Analysis of the frequency bands below 15.7 GHz**

Report ITU-R M.2318 contains the results of assessments and studies of the frequency bands between 960 MHz and 15.7 GHz considered under WRC-15 agenda item 1.17. Frequency bands below 960 MHz were assessed and do not support the implementation of WAIC systems as antenna sizes are too large given the space available on-board aircraft.

The current frequency bands allocated to the aeronautical mobile (R) service; 960-1 164 MHz, 5 030-5 091 MHz and 5 091-5 150 MHz were found to not be appropriate to accommodate WAIC systems, considering the numerous existing and planned applications in these frequency bands.

Out of the frequency bands assessed, the frequency bands 2 700-2 900 MHz, 4 200-4 400 MHz and 5 350-5 460 MHz were considered for further study. Results of the studies for the frequency bands 2 700-2 900 MHz and 5 350-5 460 MHz show that sharing between WAIC systems and existing systems is not feasible. Therefore, these frequency bands were not considered to be a candidate for WAIC systems.

Studies contained in Report ITU-R M.2319 show compatibility between WAIC systems and systems in the aeronautical radionavigation service, fixed service, Earth exploration-satellite service (passive) in the frequency band 4 200-4 400 MHz, taking into account the technical conditions defined in PDN Recommendation ITU-R M.[WAIC CONDITIONS].

In addressing this agenda item it was proposed that an adjacent band study should be carried out with FSS VSAT's operating below 4 200 MHz. However, based on the low WAIC power level it was agreed that an adjacent band study would not be required as the separation distance were expected to be in the range of 50-100 m.

#### **3/1.17/4.2 Analysis of the frequency bands above 15.7 GHz**

At this time, compatibility studies between WAIC systems and systems operating in the fixed service and the mobile service in the frequency bands 22.5-22.55 GHz and 23.55-23.6 GHz show that compatibility is not feasible.

### **3/1.17/5 Method to satisfy the agenda item**

There is one Method to satisfy the agenda item:

The method adds a primary AM(R)S allocation to the frequency band 4 200-4 400 MHz. Relevant footnotes are modified and new footnotes are added to limit the use to WAIC systems, maintain the status of passive sensing in the Earth exploration-satellite service (passive) and space research service, and maintain the use of the aeronautical radionavigation service. A new Resolution [A117-WAIC] (WRC-15) is proposed.

#### **Advantages:**

- Provides a primary aeronautical mobile (R) service allocation limited to WAIC systems.
- Ensures mandatory protection of the aeronautical radionavigation service reserved exclusively for radio altimeters.
- Provides worldwide harmonized frequency spectrum for WAIC systems.
- Provides the required wideband spectrum for implementation of WAIC systems.

#### **Disadvantages:**

- None.

### 3/1.17/6 Regulatory and procedural considerations

## ARTICLE 5

### Frequency allocations

#### Section IV – Table of Frequency Allocations

(See No. 2.1)

#### MOD

2 700-4 800 MHz

| Allocation to services |  |          |
|------------------------|--|----------|
| Region 1               | Region 2   | Region 3 |
| .../...                |  |          |
| 4 200-4 400            | <a href="#">AERONAUTICAL MOBILE (R) ADD 5.A117</a><br>AERONAUTICAL RADIONAVIGATION <a href="#">MOD</a> 5.438<br>5.439 5.440 <a href="#">ADD 5.B117</a> |          |
| .../...                |  |          |

#### MOD

**5.438** Use of the band 4 200-4 400 MHz by the aeronautical radionavigation service is reserved exclusively for radio altimeters installed on board aircraft and for the associated transponders on the ground. ~~However, passive sensing in the Earth exploration-satellite and space research services may be authorized in this band on a secondary basis (no protection is provided by the radio altimeters).~~

#### ADD

**5.A117** Use of the frequency band 4 200-4 400 MHz by stations in the aeronautical mobile (R) service is reserved exclusively for wireless avionics intra-communication systems that operate in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution [A117-WAIC] (WRC-15).

**Reasons:** This footnote makes reference to the following Resolution [A117-WAIC] (WRC-15).

#### ADD

**5.B117** Passive sensing in the Earth exploration-satellite and space research services may be authorized in the frequency band 4 200-4 400 MHz on a secondary basis.

**SUP**

**RESOLUTION 423 (WRC-12)**

**Consideration of regulatory actions, including allocations, to support  
Wireless Avionics Intra-Communications**

**ADD**

**RESOLUTION [A117-WAIC] (WRC-15)**

**Use of Wireless Avionics Intra-Communications in the  
frequency band 4 200-4 400 MHz**

The World Radiocommunication Conference (Geneva, 2015),

*considering*

- a)* that aircraft are designed to enhance efficiency, reliability and safety, as well as to be more environmentally friendly;
- b)* that Wireless Avionics Intra-Communications (WAIC) systems provide radiocommunications between two or more aircraft stations integrated into or installed on a single aircraft, supporting the safe operation of the aircraft;
- c)* that WAIC systems do not provide radiocommunications between an aircraft and the ground, another aircraft or a satellite;
- d)* that WAIC systems operate in a manner that ensures the safe operation of an aircraft;
- e)* that WAIC systems operate during all phases of flight, including on the ground;
- f)* that aircraft equipped with WAIC systems operate globally;
- g)* that WAIC systems operating inside an aircraft receive the benefits of fuselage attenuation to facilitate sharing with other services;
- h)* that Recommendation ITU-R M.2067 provides technical characteristics and operational objectives for WAIC systems,

*recognizing*

that Annex 10 to the Convention on International Civil Aviation contains Standards and Recommended Practices (SARPs) for safety aeronautical radionavigation and radiocommunication systems used by international civil aviation,

*resolves*

- 1 that WAIC is defined as radiocommunication between two or more aircraft stations located on a single aircraft, supporting the safe operation of the aircraft;
- 2 that the WAIC systems operating in the frequency band 4 200-4 400 MHz shall not cause harmful interference to, nor claim protection from systems of the aeronautical radionavigation service operating in this frequency band;

3 that the WAIC systems operating in the frequency band 4 200-4 400 MHz shall comply with Standards and Recommended Practices published in Annex 10 to the Convention on International Civil Aviation;

4 that No. **43.1** shall not apply for WAIC systems,

*instructs the Secretary-General*

to bring this Resolution to the attention of ICAO,

*invites ICAO*

to take into account Recommendation ITU-R M.[WAIC-CONDITIONS] in the course of development of SARPs for WAIC systems.

**Reasons:** This Resolution provides relevant regulatory provisions to satisfy the agenda item.