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| Summary:  |
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| Proposal: |
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DRAFT CEPT BRIEF ON 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)

# ISSUE

1. to conduct, in time for WRC-15, the necessary studies to determine the spectrum requirements needed to support WAIC systems;
2. to conduct sharing and compatibility studies, based on the results of invites ITU-R 1, to determine appropriate frequency bands and regulatory actions;
3. when conducting studies in accordance with invites ITU-R 2, to consider:
	1. frequency bands within existing worldwide aeronautical mobile service, aeronautical mobile (R) service and aeronautical radionavigation service allocations;
	2. additional frequency bands above 15.7 GHz for aeronautical services if spectrum requirements cannot be met in frequency bands studied under invites ITU-R 3 i).

# Preliminary CEPT position

* CEPT supports a primary AM(R)S allocation in the 4 200 – 4 400 MHz band limited to WAIC to accommodate the required frequency spectrum of 145 MHz

# 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. Wireless avionics intra-communications (WAIC) systems make use of radio communications between two or more stations on a single aircraft; consisting of on-board networks supporting the operation of the aircraft and its systems. WAIC system transmissions may not be limited to the interior of the aircraft structure, depending on the type of aircraft. For example, sensors mounted on the wings or engines could communicate with systems located within the airplane.

WAIC systems will be used for safety-related aircraft applications, providing communications within a single aircraft (i.e. WAIC systems do not provide communications between an aircraft and the ground, another aircraft or a satellite). WAIC systems are intended to provide the opportunity for lower cost of operations and environmental benefits.

A major application field for WAIC systems is wireless sensing. It is expected that future and even existing aircraft will be equipped with wireless sensors of all kinds. These sensors will be located at various points of the aircraft and will be used to wirelessly monitor the health of the aircraft structure and all of its critical systems, and to communicate this information within the aircraft to a central on-board entity which can make the best use of such information. WAIC systems are also intended to support data, voice and safety related video surveillance applications such as taxiing cameras and may also include communications systems used by the crew for safe operation of the aircraft.

Wireless technologies are intended to offer the means to implement systems that can enhance reliability. By having fewer wires on an aircraft, the need for wire maintenance to remediate chafing conditions, aging wiring and associated fire hazards is reduced, thereby improving the safety and reliability of the aircraft. Adding new sensors on an aircraft to monitor parameters such as equipment temperature around components to provide a more accurate status of equipment cooling has the potential to improve the reliability of aircraft systems. The introduction of these additional sensors has been limited due to wiring weight and cost impact, but they might be implemented using wireless technology.

Additional functions can be incorporated on an aircraft with wireless technology which cannot be performed with wires, e.g. engine rotor bearing monitoring. Reliably routing wiring harnesses to engine rotator bearings is impractical due to the rotation of parts. Utilizing a special sensor and transmitting this sensor information wirelessly could provide significant benefits by furnishing sensor data while the aircraft is in-flight.

To reflect the diverging conditions and requirements different categories of WAIC systems, based on the two criteria “data rate requirements” and “transmit antenna location on the aircraft”, i.e. internal or external to the aircraft structure, are defined. 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.

WAIC communication is an application of a safety service as defined in RR 1.59. As WAIC systems carry aeronautical safety related content they are classified as an application of the aeronautical mobile (route) service (AM(R)S). With the spectrum requirement of 145 MHz for WAIC as determined in the Report ITU-R M.[WAIC\_CHAR\_SPEC] the possible use of existing AM(R)S allocations should be evaluated. Priority is on frequency bands within existing worldwide aeronautical mobile service, aeronautical mobile (R) service and aeronautical radionavigation service allocations.

Based on the results of an initial evaluation of the suitability of aeronautical frequency bands for WAIC implementation under a potential AM(R)S allocation, carried out in the Working Document towards a Preliminary Draft New Report ITU-R M.[WAIC BANDS] - Consideration of the aeronautical mobile (route), aeronautical mobile, and aeronautical radionavigation services allocations to accommodate wireless avionics intra-communications (WAIC), several frequency bands have been selected for more detailed analysis.

## results of Relevant ICAO and ITU-R Studies

ITU-R has considered a number of frequency bands with respect to this agenda item. Some bands were considered as not requiring further study.

The compatibility studies are structured as follows:

Frequency bands with existing AM(R)S allocation

* 960 – 1 164 MHz
* 5 030 – 5 091 MHz
* 5 091 – 5 150 MHz

Frequency bands with ARNS or AMS allocations

* 2 700 – 2 900 MHz
* 4 200 – 4 400 MHz
* 5 350 – 5 460 MHz
* 13.25 – 13.4 GHz

Studies showed that existing AM(R)S allocations in the frequency bands 960 – 1 164 MHz, 5 030 – 5 091 MHz and 5 091 – 5 150 MHz are not appropriate to accommodate the spectrum requirement for WAIC, considering the numerous already existing and planned applications in these frequency bands.

Compatibility studies in frequency bands with other aeronautical allocations (ARNS, AMS), used e.g. by radar systems with high output power and very sensitive receivers indicate that the additional implementation of WAIC systems in these bands would cause unacceptable interference. This applies to the frequency bands 2 700 – 2 900 MHz, 5 350 – 5 460 MHz and 13.25 – 13.4 GHz.

Finally the analysis of the frequency band 4 200 – 4 400 MHz confirms that sharing between all WAIC system categories and the existing services and applications in the band is feasible. For all relevant interference scenarios it can be summarized that inside low and high data rate WAIC systems operating in accordance with the characteristics specified in Report ITU-R M.[WAIC\_CHAR\_SPEC] are compatible with all types of radio altimeters according to Recommendation ITU-R M.[RadAlt]. This includes both FMCW as well as pulsed radio altimeters. Furthermore, outside low and high data rate WAIC systems operating in accordance with the characteristics specified in Report ITU-R M.[WAIC\_CHAR\_SPEC] and in addition using directive antennas are compatible with all types of radio altimeters according to Recommendation ITU-R M.[RadAlt]. This includes both FMCW as well as pulsed radio altimeters.

## Proposed CPM method supported by CEPT

A primary allocation to the aeronautical mobile (route) service on a global basis, limited to the use by WAIC systems, in the frequency band 4 200-4 400 MHz.

Advantages

Provides worldwide harmonized frequency spectrum for the use by WAIC systems.

Disadvantages

None

Method

The regulatory approach under this method is to add a primary allocation for the AM(R)S in the Table of Frequency Allocations of RR Article 5 and adding a footnote limiting the use to WAIC systems.

# List of relevant documents

**ITU-Recommendations:**

ITU-R P.525 – Calculation of free-space attenuation

**ITU-Reports:**

ITU-R M.2197 – Technical characteristics and operational objectives for Wireless avionics intra-communications (WAIC)

Report ITU-R M.[WAIC\_CHAR\_SPEC] - Characteristics of WAIC systems and bandwidth requirements
to support their safe operation

Working document towards a PDNR ITU-R M.[WAIC BANDS] - Consideration of the aeronautical mobile (route), aeronautical mobile, and aeronautical radionavigation services allocations to accommodate wireless avionics intra-communications (WAIC)

Working document towards a preliminary draft new Report ITU-R M.[WAIC\_SHARING\_4200-4400MHz]

**Other ITU documents:**

Updated information/documentation on the ITU-R Preparatory Studies for WRC-15 are available at <http://www.itu.int/ITU-R/go/rcpm-wrc-15-studies>.

CEPT and/or ECC Documentation (Decisions, Recommendations, Reports):

EU Documentation (Directives, Decisions, Recommendations, other), if applicable:

# Actions to be taken

* Prepare contributions to the CPM text
* Finalize Working Document towards a PDNR ITU-R M.[WAIC\_BANDS]
* Finalize appropriate sharing and compatibility studies
* Finalize CPM text and if required any associated documents
* CEPT will consider further sharing and compatibility studies on other frequency bands, if necessary

# Relevant information from outside CEPT (examples of these are below)

## European Union (date of proposal)

## Regional telecommunication organisations:

APT (28 November 2013)

APT Members supports relevant ITU-R studies on WAIC in accordance with Resolution 423 (WRC-12). APT Members are also of the view that the possible introduction of WAIC systems should not cause harmful interference nor constraints to services to which the frequency band is allocated.

ATU (January 2014)

* Views WAIC communication as an application of a safety service of the Aeronautical Mobile (Route) Service (AM(R)S).
* to support the identification of 145 MHz of frequency spectrum under the AM(R)S, for the harmonized usage of WAIC.
* to support a primary allocation to the AM(R)S in the frequency band 4 200 – 4 400 MHz, limited to the use by WAIC-systems.
* to support further sharing and compatibility studies on other frequency bands as necessary.

Arab Group (1 December 2013)

ASMG Position:

Follow up the current studies and work on studying the candidate bands in order to support wireless avionics intra-communications (WAIC), with ensuring the protection of the operating systems according to the current allocations.

Support the application to be under the Aeronautical mobile route service.

CITEL ( March 2014)

Inter-American Proposals

B, CAN, DOM, EQA, NCG, SLV, USA

* ADD footnote to the Table of Frequency Allocations (4 200-4 400 MHz) allowing the provision of wireless avionics intra-communications
* ADD footnote specifying that passive sensing in the Earth exploration-satellite and space research services may be allocated on a secondary basis (maintaining the current allowance of these services), and that no protection is afforded to these services

RCC (25 April 2013)

The RCC administrations consider that WAIC systems shall be operated in frequency bands allocated to aeronautical services.

The RCC administrations consider that the frequency bands used by WAIC shall be harmonized in all three Regions.

The RCC administrations consider that the introduction of WAIC systems shall not impose constraints on other systems operating in shared frequency bands.

## International organisations

IATA (date of proposal)

ICAO (July 2013)

Support any necessary additional global aeronautical mobile (route) service allocation required to facilitate the implementation of WAIC, provided technical studies show that WAIC systems will not cause harmful interference to existing or planned aeronautical systems operating in frequency bands allocated to aeronautical safety services.

IMO (date of proposal)

NATO (date of proposal)

Hallo Standard

SFCG (July 2013)

SFCG supports the protection of existing space science service allocations. No identification of bands for WAIC systems operations should be made in bands allocated to science services unless acceptable sharing criteria with the affected space science service are developed. Given that the WAIC proponents are seeking safety service allocations for WAIC operations, studies also need to verify that the proposed WAIC systems would not receive harmful interference from the existing space science services operating with their current technical and operational parameters.

WMO and EUMETNET ( March 2014)

Consider possible spectrum requirements and regulatory actions, including appropriate aeronautical allocations, to support wireless avionics intra-communications (WAIC) (see section 3.7);

ESA (date of proposal)

Eurocontrol (date of proposal)

## OTHER INTERNATIONAL AND REGIONAL ORGANISATIONS

CRAF (17 January 2013)

Comments:

The RAS bands that may potentially be affected are given in the following table.

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| Frequency Band | RAS Status | FN | RAS Utilization  |
| 2655-2690 | MHz | sec | 5.149 | Continuum observations, VLBI |
| 2690 – 2700 | MHz | PRI | 5.340 | Continuum observations, VLBI  |
| 4990-5000 | MHz | PRI | 5.149 | Continuum observations, VLBI |
| 5000-5030 | MHz | sec |   | Continuum observations, VLBI |
| 15.35-15.4 | GHz | PRI | 5.340 | Continuum observations, VLBI |

Unwanted emissions from WAIC systems may significantly affect RAS use in these bands owing to the acknowledged susceptibility of the RAS to airborne sources of interference. To ensure adequate protection, all RAS bands that might be affected should not be subjected to interference levels from the emissions of WAIC systems that exceed those specified in Recommendation ITU-R RA.769-2.

CRAF position:

CRAF supports the protection of existing radio astronomy allocations. No new allocations for WAIC systems should be made unless acceptable compatibility criteria are established and included in subsequent regulations.

EBU (date of proposal)

GSMA (date of proposal)

ESA (date of proposal)

Eurocontrol (date of proposal)