

ITU-R Recommendations & Reports related to aeronautical services

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ITU-R Study Groups

- **ITU-R Studies** - development of technical and regulatory basis for WRC decisions
- **SG** develop international standards (recommendations), reports, opinions and handbooks on Radiocommunication matters
- **Examples of steps in study process:**
 - ✓ determining spectrum requirements (derived from traffic estimations)
 - ✓ technical and operational characteristics
 - ✓ studies of compatibility between new and existing applications
 - ✓ identification of candidate bands, regulatory solutions
- **ITU-R consists of 6 SG, composed by 21 Working Parties (WP)**
- **ITU-R SG 5, WP5B** deals with studies related to the aeronautical mobile service and the radiodetermination service, including both radiolocation and radionavigation services

Purpose of ITU-R Recommendations and Reports

- To be included in the RR as reference document providing technical, operational or regulatory conditions for implementing the provisions of the RR
- To facilitate the international coordination and avoid/solve the harmful interference for frequency management between systems or countries
- To support the studies of WRC agenda items to facilitate the additional frequency allocation to various services or frequency identification in the RR for emerging systems/applications, e.g., IMT, to ensure sharing use of the same frequencies

ITU-R Recommendations and Reports

- ITU-R Recommendation provides
 - **recommended specifications** of systems,
 - compatibility and protection **criteria**, or
 - **operational procedures** for a specified application.

E.g.,

[Recommendation ITU-R M.1458](#)

Described the **recommended specifications** of the HF digital data link for data transmission system using class of emission J2D

- ITU-R Report normally provides the **results of sharing studies** between radiocommunication systems.
E.g.,
 - sharing studies **between aeronautical systems** in the bands exclusively allocated to aeronautical service

[Report ITU-R M.2235](#)

Sharing studies between aeronautical mobile (Route) service with other systems in the frequency band 960-1 164 MHz,

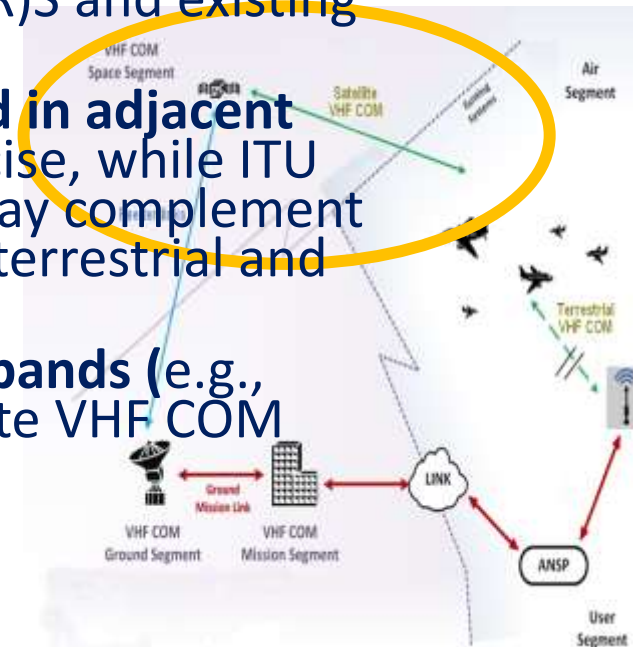
- sharing studies **between aeronautical systems and non-aeronautical systems**

[Report ITU-R M.1841](#)

Compatibility between FM sound-broadcasting systems in the frequency band of about 87-108 MHz and the aeronautical ground-based augmentation system (GBAS) in the frequency band 108-117.975 MHz

ITU-R Recommendations and Reports relating to aeronautical services

- Preliminary draft new Report ITU-R M.[SPACE-VHF]
Space-based aeronautical VHF communications in the frequency band 117.975-137 MHz
 - For preparation for WRC-23 Agenda Item 1.7 to facilitate the new frequency allocation to AMS(R)S in the VHF frequency band
 - To define relevant technical characteristics for sharing studies
 - The technical characteristics of satellite VHF COM system is the same as the ground-based VHF Voice and Data Link systems derived from ICAO SARPs
 - To carry out the study compatibility between satellite systems in AMS(R)S and existing services in-band and in adjacent bands.
 - **Between aeronautical system in-band (AM(R)S and AM(OR)S) and in adjacent band (ARNS):** through ICAO conventional frequency planning exercise, while ITU coordination procedures under Article 9 of the Radio Regulation may complement the ICAO framework in order to ensure full compatibility between terrestrial and satellite VHF COM systems;
 - **Between aeronautical and non-aeronautical systems in adjacent bands (e.g., MSS, Met Sat, SRS):** by limitation of unwanted emissions of satellite VHF COM systems based on ICAO SARPs.



ITU-R Recommendations and Reports relating to aeronautical services

■ Report ITU-R M.2235

Aeronautical mobile (route) service sharing studies with other systems in the frequency band 960-1 164 MHz

- Background
 - WRC-07 allocated aeronautical mobile (route) service in the band
 - WRC-12 agenda item 1.4 to study sharing possibility between AM(R)S and ARNS systems operating in the band 960-1 164 MHz
- Future aeronautical mobile (R) system (AM(R)S): L-band digital aeronautical communication system (L-DACS) to support future air traffic management (ATM) requirements of adequate capacity and quality of services
- Sharing studies with
 - **non-ICAO aeronautical radionavigation systems** operated in the aeronautical radionavigation service (ARNS) by countries listed in RR No. **5.312**.
 - **Radionavigation satellite service (RNSS)** operated in adjacent bands above 1 164 MHz
 - **ICAO aeronautical radionavigation systems** was considered by ICAO not covered
- Sharing conditions incorporated into Resolution 417 (Rev. WRC-12) of the Radio Regulations

Max e.i.r.p. (ground station)

Emissions in the frequency band 960-1 164 MHz (Maximum allowable e.i.r.p. in the frequency band 960-1 164 MHz as a function of the carrier central frequency) for non-pulsed AM(R)S transmissions				Emissions in the frequency band 1 164-1 215 MHz	
AM(R)S centre frequency < 1 091 MHz	AM(R)S centre frequency 1 091-1 119 MHz	AM(R)S centre frequency 1 119-1 135 MHz	AM(R)S centre frequency 1 135-1 164 MHz	1 164-1 197.6 MHz	1 197.6-1 215 MHz
51.6 dBW	Linearly decreasing from 51.6 to 23.6 dBW	Linearly decreasing from 23.6 to -2.4 dBW	Linearly decreasing from -2.4 to -68.4 dBW	-90.8 dBW in any 1 MHz of the band 1 164-1 197.6 MHz	-90.8 dBW in any 1 MHz of the band 1 197.6-1 215 MHz

- Recommendation ITU-R SF.1486

Sharing methodology between fixed wireless access (FWA) systems in the fixed service (FS) and very small aperture terminals (VSAT) in the fixed-satellite service (FSS) in the 3 400 - 3 700 MHz band (C-band)

- Be contained in Resolution **154** (Rev. WRC-15) as one of the references to support operation of FSS earth stations for the safe communication of aircraft sharing with FWA systems in FS;
- Address sharing methodologies between VSAT earth stations in the FSS and FWA stations in the FS in C - band
- Provide the interference mitigation methods, e.g., location of antenna of earth station, the installation of natural or man-made shielding close to the VSAT antennas, distance separation, etc.

ITU-R Recommendations and Reports relating to aeronautical services

■ Recommendation ITU-R M.1841

Compatibility between FM sound-broadcasting systems in the frequency band of about 87-108 MHz and the aeronautical ground-based augmentation system (GBAS) in the frequency band 108-117.975 MHz

- To study any compatibility issues between the broadcasting and aeronautical services operating around 108 MHz in accordance with Resolution 413 (WRC-03).
- To provide technical and operational requirements for administrations as a technical guideline for sharing compatibility between GBAS operating in aeronautical radionavigation service and FM sound-broadcasting systems operating in the frequency nearby 108 MHz, including
 - Compatibility criteria;
 - Interference assessment method
 - Practical verification of the interference

■ Recommendation ITU-R M.1458

Use of the frequency bands between 2.8-22 MHz by the aeronautical mobile (R) service for digital data transmission system using class of emission J2D

- Based on ICAO standards and recommended practices (SARPs) for digital HF data link using class of emission J2D
- The provisions of AP 27 allotment Plan applicable to the frequency assignment using class of emission J2D
- Technical characteristics to be used for coordination if needed between administrations when to assign the frequencies in conformity with the AP 27 allotment Plan to stations using class of emission J2D

ITU-R Recommendations and Reports relating to aeronautical services

- **Wireless avionics intra-communications (WAIC) is radiocommunication between two or more points on a single aircraft**
(Integrated with the aircraft. Part of a closed, exclusive network required for aircraft operation. Only safety-related applications. Based on short range radio technology (< 100m).
- This technology make new generation of aircraft more reliable, light, less fuel consuming and environmentally friendly
- **WRC-15 allocated of 4 200-4 400 MHz to AM(R)S reserved for WAIC**
- ITU-R developed the following Recommendations describing the technical and operational characteristics for WAIC system
 - Recommendation ITU-R **M.2067** Technical characteristics and protection criteria for Wireless Avionics Intra-Communication systems;
 - Recommendation ITU-R **M.2085** Technical conditions for the use of wireless avionics intra-communication systems operating in the aeronautical mobile (R) service in the frequency band 4 200-4 400 MHz.



Summary

- **ITU-R provides spectrum resources for all radiocommunication systems, including aeronautical systems**
- **ITU-R ensures interference-free operation of different radio equipment and its compatibility with other terrestrial systems (through compatible allocations, channeling arrangements, technical limitations)**
- **ITU-R standardizes radio equipment ensuring their interoperability**

Thank you!

ITU-R Recommendations relating to aeronautical systems are available at <https://www.itu.int/rec/R-REC-M/en>. Some examples are shown below.

- [M.633](#) Transmission characteristics of a satellite emergency position-indicating radio beacon (satellite EPIRB) system operating through a satellite system in the 406 MHz band
- [M.1089](#) Technical considerations for the coordination of mobile-satellite systems relating to the aeronautical mobile satellite (R) service (AMS(R)S) in the bands 1 545 to 1 555 MHz and 1 646.5 to 1 656.5 MHz
- [M.1458](#) Use of the frequency bands between 2.8-22 MHz by the aeronautical mobile (R) service for data transmission using class of emission J2D
- [M.1464](#) Characteristics of radiolocation radars, and characteristics and protection criteria for sharing studies for aeronautical radionavigation and meteorological radars in the radiodetermination service operating in the frequency band 2 700-2 900 MHz
- [M.1841](#) Compatibility between FM sound-broadcasting systems in the frequency band of about 87-108 MHz and the aeronautical ground-based augmentation system in the frequency band 108-117.975 MHz
- [M.2085](#) Technical conditions for the use of wireless avionics intra-communication systems operating in the aeronautical mobile (R) service in the frequency band 4 200- 4 400 MHz
- [M.2089](#) Technical characteristics and protection criteria for aeronautical mobile service systems in the frequency range 14.5-15.35 GHz
- [M.2114](#) Technical and operational characteristics of and protection criteria for aeronautical mobile service systems in the frequency bands 22.5-23.6 GHz and 25.25-27.5 GHz
- [M.2115](#) Technical and operational characteristics of and protection criteria for aeronautical mobile systems operating in the 45.5-47 GHz frequency range
- [M.2116](#) Technical characteristics and protection criteria for the aeronautical mobile service systems operating within the 4 400-4 990 MHz frequency range
- [M.2120](#) Technical characteristics and protection criteria for aeronautical mobile systems operating in the mobile service in the frequency range 21.2-22 GHz

ITU-R Recommendations relating to aeronautical systems are available at <https://www.itu.int/rec/R-REC-M/en>. Some examples are shown below.

- [M.910](#) Sharing between the maritime mobile service and the aeronautical radionavigation service in the band 415-526.5
- [M.2118](#) Compatibility between proposed systems in the aeronautical mobile service and the existing fixed-satellite service in the 5 091-5 250 MHz band
- [M.2119](#) Sharing between aeronautical mobile telemetry systems for flight testing and other systems operating in the 4 400-4 940 and 5 925-6 700 MHz bands
- [M.2120](#) Initial estimate of new aviation AM(R)S spectrum requirements
- [M.2121](#) Guidelines for AM(R)S sharing studies in the 960-1 164 MHz band
- [M.2168](#) Compatibility between a proposed new aeronautical mobile (R) service (AM(R)S) system and both radionavigation-satellite service (RNSS) operating in the 5 000-5 010 MHz band and radio astronomy in the adjacent band 4 990-5 000 MHz
- [M.2170](#) Compatibility analysis and results for radiolocation systems planned to operate in the 15.4 to 17.3 GHz band and aircraft landing system operating in the 15.4-15.7 GHz band as well as the radio astronomy service operating in the adjacent band 15.35-15.40 GHz, FSS systems and aeronautical radionavigation systems
- [M.2235](#) Aeronautical mobile (route) service sharing studies in the frequency band 960-1 164 MHz
- [M.2414](#) Performance measurements of interference into one example of a Radar operating under the aeronautical radionavigation service in the frequency band 2 700-2 900 MHz
- [M.2436](#) The global aeronautical distress and safety system