

Additional comments:

In order to maintain today's safety and required performance of aeronautical systems DFS opposes sharing of the band 960 to 1164 MHz with PMSE.

Sharing may at best be possible at a case to case basis. It will require continuous work to establish the Extraneous Signal Environment (ESE) for all potential PMSE sites and updates on the applicable interference criteria, whenever existing ARNS Hard-, Soft and Firmware is modified, when a new system and its equipment is in operation or when specification for ARNS equipment are modified.

Reasoning for the reply:

From the knowledge accumulated during numerous Radio Frequency Compatibility assessment work performed to allow sharing of non-Aeronautical Radio Navigation System (ARNS) systems in the band 960 to 1215 MHz, it is known that sharing is only possible if Electromagnetic Compatibility with existing and future ARNS systems and equipment operating from the ground and from aircraft is established through extensive studies and measurements on equipment.

The best example for the complexity involved is the compatibility work between the JTIDS/MIDS and the by International Civil Aviation Organization (ICAO) standardized systems for ranging DME (=TACAN), Secondary Surveillance Radar (SSR) legacy Mode A and C, today's SSR Mode S and all the other Mode S based systems like Airborne Collision Avoidance System (ACAS) or Multilateration systems (MLAT) used for area service, Approach (APP) and Departure (DEP) to airports and ground movements on airports .

Even though the JTIDS/MIDS wave forms were shaped after measurements to have minimal impact onto the existing ARNS systems and equipment at the time, continued studies and measurements over the past 40 years were still necessary; in part to account for evolution of the ARNS systems and equipment. Today's sharing status is defined in the national Frequency Clearance Agreement (FCA) for JTIDS/MIDS. In the process of this work a number of new interference mechanisms previously unknown were identified.

The theoretical RFI approach within ITU and CEPT focuses mostly on undesired power of interferer and its effect on a receiver. However receiver today have to operate 24/7 in today's dense and challenging Extraneous Signal Environment (ESE), and depend on elaborate detection and processing circuits. It is therefore not just the receiver alone, but also the attached detection and processing circuits and their feedback onto the receiver that needs to be taken into account. Last but not least the monitoring circuits, which if interfered, will switch off the ARNS equipment and run a diagnostic program. The resulting outages of ARNS equipment, leads to severe capacity restrictions, especially if they are part of APP and DEP procedures to an airport. While operation within the parameter specified by ICAO is achieved, it may not always be the case, when ARNS equipment is subjected to additional non aeronautical signals in an already challenging ESE. ICAO did not foresee the need to detect and identify RFI, in a band that was at the time solely allocated to aeronautical systems. Therefore no requirements are contained in the relevant ICAO Standards and Recommended Practices (SARPS) Volumes of ICAO Annex 10 and related documents nor

the relevant Minimum Operational Performance Standards (MOPS) for manufacturer.

Radar target losses due to interference are insidious, because they do not cause any indication on a display or warn by audio ATC controller and pilots that targets were lost. The impact to ACAS is similar, loss of aircraft targets for ACAS equipment means it cannot detect and warn the pilot of possible collision between aircraft, nor can it generate resolution advisories to the pilots of aircraft involved to allow to avoid collisions.

Susceptibility to Radio Frequency Interference (RFI) in ARNS equipment varies not only from manufacturer to manufacturer, but also from design to design for the same manufacturer, e.g. because of varying operational performance requirements like for general, commercial or military aviation. In addition to the hardware design also the firmware and settings available to the equipment operator define the RFI susceptibility to a large degree.

Furthermore the evolution of ARNS systems and equipment will require that the decision made at the present time may have to be revised, when new equipment proves susceptible to RFI from PMSE in the existing ARNS environment, e.g. SSR Mode S with an additional phase overlay modulation, which is presently in the standardisation process or the future L-Band Digital Communication system (LDACS).

Question 1: Do you agree with our assessment that minimal growth in demand and stability in spectrum supply means that we do not need to implement any changes to meet the ongoing requirements for talkback, audio links and telemetry and tele-command applications?:

No

Question 2: Do you agree with our sharing analysis which concludes that audio PMSE (low power microphones and IEMs) could co-exist with incumbent services in the bands 960-1164 MHz and 1525-1559 MHz? If not please provide specific details/evidence to illustrate your view.:

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The evolution of ARNS systems and equipment will require that the decision made at the present time may have to be revised, when new ARNS equipment proves susceptible to RFI from PMSE in the existing ARNS environment, e.g. SSR Mode S with an additional phase overlay modulation, which is presently in the standardisation process or the future L-Band Digital Communication system (LDACS).

For a more detailed reasoning see detailed reply in additional comments.

Question 3: Do you have any comments on our proposal to allow low power audio PMSE applications (wireless microphones and IEMs) access to the 960-1164 MHz band?:

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For a more detailed reasoning see detailed reply in additional comments by DFS.