

REPORT ITU-R M.2121

Guidelines for AM(R)S sharing studies in the 960-1 164 MHz band

(2007)

1 Introduction

Current aviation communication bands are severely congested and further pressured by the introduction of new aviation applications and security requirements. In addition, recent experience has shown that evolving technology for navigation and surveillance may necessitate allocations that are more encompassing than simply aeronautical radionavigation service (ARNS).

Based on available studies, two distinct categories of AM(R)S spectrum are required. The first – for surface applications at airports including data links – is distinguished by a high data throughput, however only moderate transmission distances and it is expected that single frequency resources can be shared at multiple geographic locations. The second category, like the current very high frequency (VHF) AM(R)S, will require longer propagation distances (e.g. out to radio line-of-sight), moderate bandwidth, and a number of distinct channels to allow for sector-to-sector assignments. This report deals with the latter category, and initial estimates of potential spectrum requirements have been determined taking into account evolving aeronautical applications, and integration of a new system on an aircraft. For the 960-1 164 MHz band, that estimate is that approximately 60 MHz will be required.

The 960-1 164 MHz band is allocated to ARNS in all Regions on a primary basis. Even though overall in the band 960-1 164 MHz the usage is generally high, in the sub-bands 960-977 and 1 143-1 164 MHz usage by International Civil Aviation Organization (ICAO) Standard systems is relatively low. The band 960-1 164 MHz is also occupied by different systems that are either operated on a nationally coordinated or on a non-interference basis.

Compatibility with existing or planned aeronautical systems operating in accordance with international aeronautical standards will be ensured by ICAO. In some countries in Region 1, the frequency band 960-1 164 MHz is also used by systems in aeronautical radionavigation service for which no ICAO Standards and Recommended Practices (SARPs) have been developed. Studies regarding compatibility between AM(R)S and these systems need to be undertaken in the ITU-R.

This document presents status on ongoing studies within national administrations, ICAO and ITU-R aimed at:

- a) defining the assumptions and key characteristics for an aeronautical future communication system (FCS) operating in the considered AM(R)S spectrum allocation in the band 960-1 164 MHz.
- b) considering the topic of the FCS compatibility with services (as defined in the ITU-R radio regulations) operating in the adjacent bands below 960 and above 1 164 MHz.
- c) supporting the WRC CPM draft resolution text aiming at adding an AM(R)S allocation in the band 960-1 164 MHz, without constraining in any way the operations and the development of systems operating under ARNS in accordance with ICAO standards and recommended practices.

2 Current use of the band

The 960-1 215 MHz band is an ARNS band that is reserved and protected for aeronautical navigation services. This band is already used by many civil aeronautical systems: DME, SSR, GNSS signals etc. There is also the universal access transceiver (UAT) datalink system that will operate in the future on the 978 MHz frequency. Other systems also operate within this band on a nationally-coordinated basis.

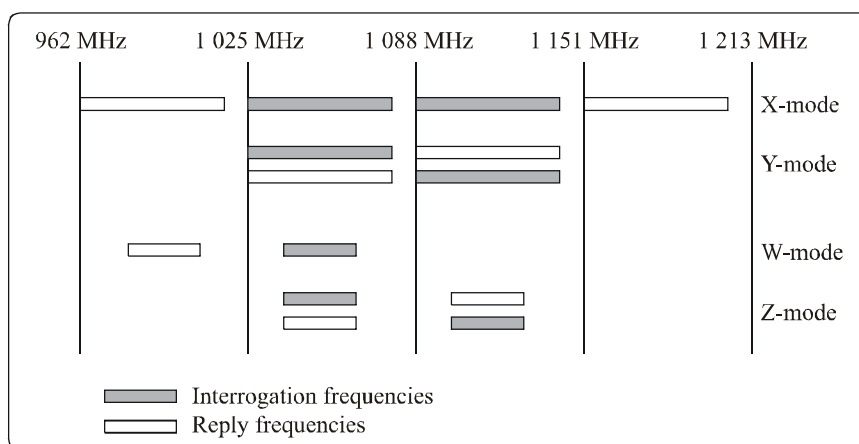
Distance measuring equipment (DME)

The DME system is an ICAO standardized pulse-ranging system for aircrafts. It allows for the determination of the slant range between an aircraft and known ground locations. A DME ground station may be combined with a collocated VOR, ILS or MLS system to form a single facility. When this is done, the DME frequency is paired with the VOR, ILS or MLS frequency according to ICAO provisions.

The DME onboard interrogator obtains a distance measurement by transmitting pulse pairs and waiting for pulse pairs replies from the ground beacon. Each pulse pair is returned by the transponder after a fixed delay. Based on the measured propagation delay, the aircraft interrogator equipment calculates the distance (slant range) from the transponder to its current location. Pulses have a half-amplitude duration of 3.5 μ s and pulse pair spacing depends on the mode. There are four DME modes (X, Y, W and Z) but currently modes W and Z are not used.

DME frequencies are spaced in 1 MHz increments throughout the 962 to 1 213 MHz band. Interrogation frequencies are contained within the band 1 025 to 1 150 MHz, and reply frequencies from the beacon are on paired channels located either 63 MHz below or above the corresponding interrogation frequency. Figure 1 depicts the standard DME/TACAN channel plan. Note that secondary surveillance radar (SSR) and ACAS operate on the frequencies 1 030 and 1 090 MHz, so DME channels lying near those frequencies, and the corresponding ground reply frequencies are not used. Note this frequency plan is also valid for the TACAN system that is described below.

FIGURE 1
Standard DME/TACAN Channel Plan



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Secondary surveillance radars (SSR)

ATC secondary surveillance systems (SSR) Mode A, Mode C, and Mode S are cooperative radars that operate by interrogating transponders onboard suitably equipped aircrafts.

Ground stations interrogate on a frequency of 1 030 MHz and aircraft respond on 1 090 MHz. Because of the aircraft active response, SSRs typically operate at much lower power levels, a few