RECOMMENDATION ITU-R M.1829

Method for determining the necessary geographical separation distances, in the 5 GHz band, between the international standard microwave landing system (MLS) stations operating in the aeronautical radionavigation service and transmitters operating in the aeronautical mobile service (AMS) to support telemetry

(2007)

Scope

This Recommendation provides the method for determining the necessary geographical separation distances between international-standard MLS stations operating in the 5 GHz band and telemetry receivers.

The ITU Radiocommunication Assembly,

considering

a) that the band 5 030-5 150 MHz is allocated to the aeronautical radionavigation service on a primary basis;

b) that future new systems might cause interference to MLS receivers during approach and landing if sufficient sharing studies are not conducted;

c) that the MLS can be protected through the implementation of an adequate separation distance between a radiating aeronautical mobile service (AMS) transmitter to support telemetry and MLS receivers;

d) that WRC-03 has adopted Resolution 230 (WRC-03) to conduct technical, operational and regulatory studies to develop the necessary frequencies for the future aeronautical telemetry links,

recognizing

a) that the methods contained herein are based on current specifications for international-standard MLS receiving equipment;

b) that No. 4.10 of the Radio Regulations (RR) requires special measures for the protection of radionavigation and safety services;

c) that the band 5 030-5 150 MHz is to be used for the operation of the international standard microwave landing system (MLS) for precision approach and landing; the requirements for this system shall take precedence over other uses of this band in accordance with RR No. 5.444,

recommends

1 that the method described in Annex 1, for determining the necessary geographical separation distances R_{min} between international-standard MLS stations operating in the 5 GHz band and telemetry transmitters should be used.

Annex 1

Example of method for determining minimum separation distances, in the 5 GHz band, between the international standard microwave landing system (MLS) stations operating in the aeronautical radionavigation service and transmitters operating in aeronautical mobile service for aeronautical telemetry usage

Figure 1 shows:

– which item of the MLS system is considered to be protected.

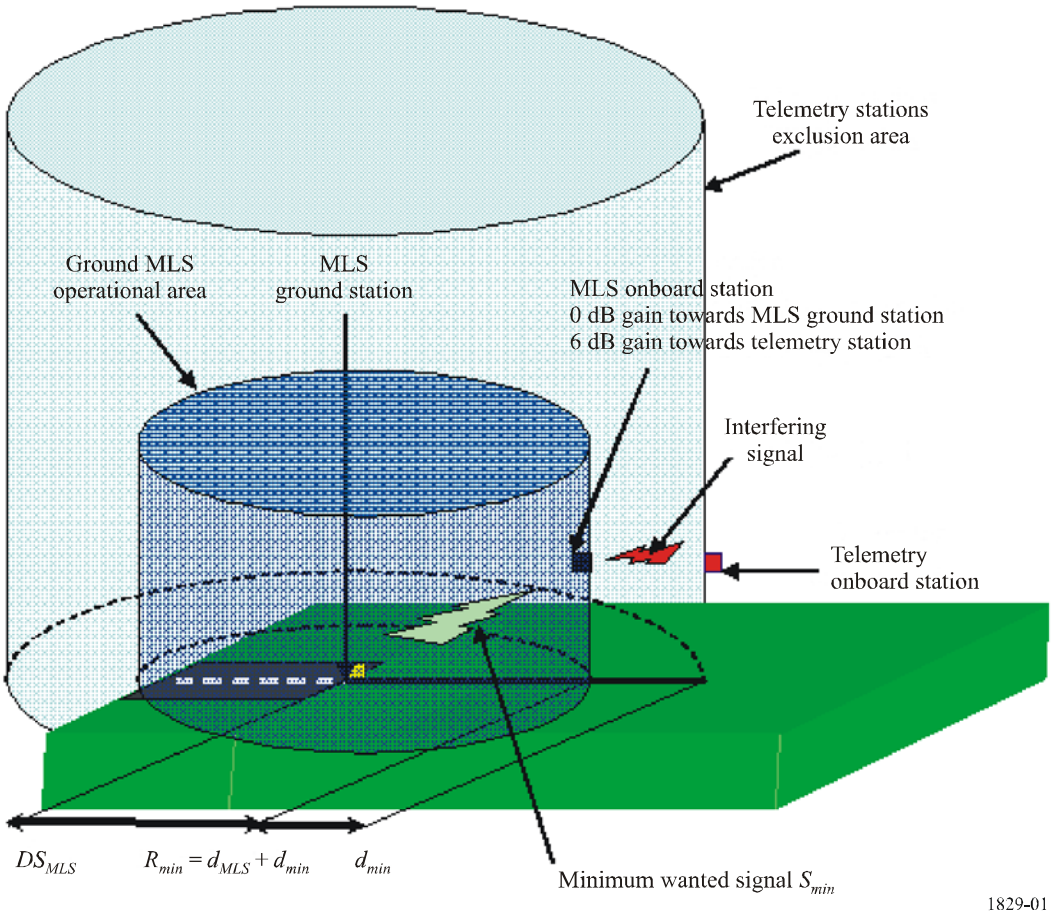
– what is the source of potential interference from flight testing telemetry transmitters.

– how the MLS receiver in the landing approach should be protected.

– what the assumptions taken for the MLS antenna gain are toward the ground MLS station and the interfering telemetry station, respectively.

FIGURE 1

Worst-case scenario



The maximum ground projection distance between the ground MLS station and the MLS receiver is d_{MLS} = 43 km. The purpose of this Annex is to provide a methodology to compute the ground projection distance R_{min} between the telemetry station and the ground MLS stations which will ensure that all MLS stations located in the ground MLS station operational area will be protected. This methodology can be used by administrations when bilaterally coordination is necessary.

As illustrated in Fig. 1, the landing aircraft with the MLS receiver is inside the smaller cylinder (located inside the larger cylinder) which has a radius of 43 km and a maximum height above ground of 6 000 m (identified by ICAO as 20 000 ft). The outer or larger cylinder, unlimited in altitude, is the volume determined by the minimum distance d_{min}. Any telemetry stations outside this volume will not cause harmful interference into MLS receivers located in the ground MLS operational area.

This annex sets forth a method for determining minimum separation distances relative (deducted from maximum input interfering powers) to current and planned MLS stations.

Range-separation may be defined as a result of specifications for MLS interference susceptibility criteria which correspond to a power level before the MLS antenna, given in the MLS receiver bandwidth. Therefore the following condition should always be verified to protect the MLS receivers.

$$\left(\frac{\lambda}{4\pi d_{min}}\right)^2 \cdot P_t \cdot G_t \cdot FDR \leq P_r \tag{1}$$

where:

$(\lambda/4 \cdot \pi \cdot d_{min})^2$: represents the free space losses at a considered ground projection distance d_{min} from the transmitter. d_{min} is the ground projection distance between the aircraft transmitting telemetry signal and the aircraft with the MLS receiver which is in the ground MLS station operational area

P_t: power (W) transmitted by the telemetry transmitter

G_t: maximum telemetry transmitter antenna gain toward the MLS receivers' operational area

P_r: MLS interference susceptibility level

FDR: frequency dependent rejection defined by the ratio between the power transmitted in the MLS receiver bandwidth centred at the MLS centre frequency f_c and the total power transmitted. The FDR is defined in Recommendation ITU-R SM.337:

$$FDR\ (\Delta f) = \frac{\int_0^{+\infty} F(f)\left(H(f + \Delta f)\right)^2 \mathrm{d}f}{\int_0^{+\infty} F(f)\,\mathrm{d}f} \tag{2}$$

$F(f)$: power spectral-density related to the telemetry transmitter of the potential interferer. $F(f)$ takes into consideration the attenuation associated to an output filter

$H(f)$: frequency response of the MLS receiver

$$\Delta f = f_t - f_r$$

where:

f_t: telemetry centre frequency

f_r: MLS receiver tuned frequency.

From equation (1) the minimum ground projection distance between the telemetry transmitters and the MLS receivers is given by the following equation (d_{min} is expressed in km):

$$d_{min(\mathrm{km})} = \frac{\lambda}{4\pi \cdot 1\,000}\sqrt{\frac{Pt \cdot Gt \cdot FDR}{Pr}} \tag{3}$$

The protection distance (minimum horizontal separation distance between the MLS ground transmitter and the telemetry transmitter) is defined as follows:

$$R_{min(\mathrm{km})} = d_{min} + d_{MLS} = \frac{\lambda}{4\pi \cdot 1\,000}\sqrt{\frac{Pt \cdot Gt \cdot FDR}{Pr}} + d_{MLS} \tag{4}$$

where d_{MLS} represents the coverage area of the MLS station (see Fig. 1).

It must be noted at this level that the atmospheric attenuation is not taken into consideration. Therefore, the operation of the equipment considered for the calculation at a greater distance than one which was calculated offers the guaranty of no prejudicial interference.

This protection distance may be adjusted on a case-by-case basis, as the result of agreement between the administrations concerned.