



Deviation request #67 for an ETSO approval for CS-ETSO applicable to ETSO-2C66b for Distance Measuring Equipment (DME) operating within the radio frequency range of 960-1215 Megahertz Consultation Paper

1. Introductory note

The hereby presented deviation requests shall be subject to public consultation, in accordance with EASA Management Board Decision No 7-2004¹ products certification procedure dated 30 March 2004, Article 3 (2.) of which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

2. ETSO-2C66b for DME

Deviate from ETSO-C52B §3.1.1 which is based on EUROCAE ED-54 document (1987) for the interpretation of EUROCAE ED-54 document §3.2.2 b) requirement for "DME/N Minimum Performance Specification standard conditions" "Multi-channel mode (scanning DME) "Search and Track" "Free Scanning".

Requirement:

EUROCAE ED-54 document §3.2.2 b) states the following:

b) Free Scanning

In the presence of a Standard Test Signal with a 70% reply efficiency the equipment shall remove its warning signal within 3 seconds for the nearest station. Two seconds after the warning removal for one channel, tracking shall be effective for that channel.

NOTE Tests can be made only on one channel.

Industry:

EUROCAE ED-54 §3.2.2 b) specifies three seconds (3 seconds) to scan the nearest station and an additional two seconds (2 seconds) to track the selected frequency, thus five seconds (5 seconds) to track the nearest station. Then, EUROCAE ED-54 §6.4.2.2.2 b) states that the "time between the establishment of the interrogator on the free scanning mode and the display of all channels with right distances and right velocity" should be measured. Moreover, "two seconds after the display of one frequency and associated distance the track must be effective with the distance accuracy of paragraph 3.1". Instead of performing the tests on one channel only ("Tests can be made only on one channel"), it is proposed to perform a global test on all channels as specified in ARINC 709-8 which requires a maximum of three minutes (3 minutes) for the complete scanning of all channels. Equivalent level of safety is provided by the fact that the ARINC 709-8 provides a quantified objective which is tailored to the free scanning mode. EUROCAE ED-54 quantified objective is only focused on the nearest station.

¹ Cf. EASA Web: http://www.easa.europa.eu/ws_prod/g/doc/About_EASA/Manag_Board/2004/mb_decision_0704.pdf

EASA:

FAA TSO-C66c is based on the minimum performance standards set forth in Radio Technical Commission for Aeronautics (RTCA) Document No. DO-189 (Minimum Operational Performance Standards for airborne distance measuring equipment (DME) operating within the Radio Frequency Range of 960-1215 Megahertz). RTCA Document No.-189 does not have a similar requirement as EUROCAE ED-54 §3.2.2 b).

The measurements procedures of section §6.4.2.2.2 (Search and Track/Measurements procedure) in EUROCAE document ED-54 do not provide a quantified objective for the maximum duration for the display of all channels in free scanning mode but only a requirement for the tracking of a single frequency.

b. Free scanning:

Connect the equipment as shown on figure 6.5.

Set the DME test sets as described in the paragraph 6.4.2.2.2.a. and in addition set a velocity between 0 and 250 knots for each simulated distance.

Set the DME interrogator on free scanning mode. Using a stopwatch determine the time between the establishment of the interrogator on the free scanning mode and the display of all channels with right distances and right velocity. Two seconds after the display of one frequency and associated distance the track must be effective with the distance accuracy of paragraph 3.1.

All measured times shall be examined to determine the compliance with the requirements of paragraph 3.2.

This requirement does not completely address the definition provided for “free scan” in EUROCAE ED-54 §1.6 where it is described as a mean to “select closest available stations”:

1.6 DEFINITION OF TERMS

Scanning Mode - Mode of operation where the interrogator is capable of scanning through two or more DME channels to provide distance information from the tracked stations.

Directed Scan - Scan of a number of designated channels.

Free Scan - Scan of channels other than those selected for directed scan to select closest available stations.

ICAO Doc 8071 (Manual on testing of radio navigation aids, Volume 1, Testing of ground-based radio navigation systems), Volume I, Amendment No. 1 Chapter 3 paragraph “3.3.20 h Search speed “states that the: “**Search speed should be at least 10 NM per second.**”

Chapter 3. Distance Measuring Equipment (DME)

- h) **Search speed. Search speed should be at least 10 NM per second.**

In ICAO documentation, the coverage for DME depends on local operational requirements. However, EUROCAE ED-54 document and RTCA DO-189 document define the maximum range for the DME/N.

According to EUROCAE ED-54 document §7.2.2.2, the maximum range is 130 NM:

7.2.2.2 DME/N Equipment:

b. Maximum Range

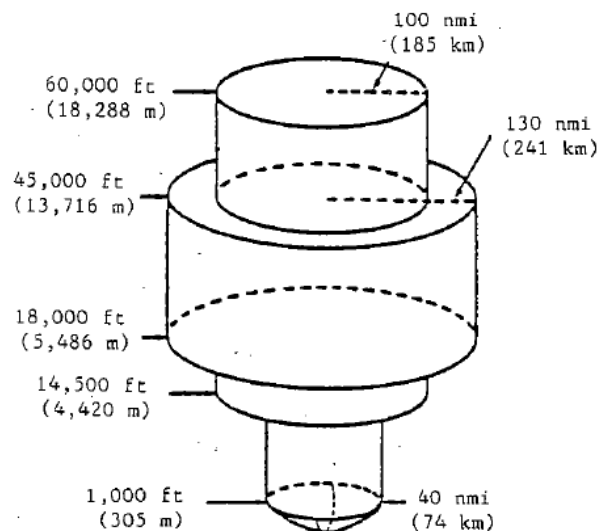
The maximum range to be demonstrated for the two classes of equipment as defined in paragraph 1.4.2 are:

130 nm for aircraft certified for operation above 18,000 feet.

40 nm for aircraft certified for operation only below 18,000 feet.

RTCA DO-189 document §1.2 defines standard service volumes based on operation type and altitude. It also defines an expanded service volume of 200 NM (200 NM where path loss is no more severe than what is experienced at the worst case points of the standard volumes) in §1.4.2.

FIGURE 1-1 STANDARD HIGH
ALTITUDE SERVICE VOLUME



1.4.2 Range

DME interrogator characteristics (power output and receiver sensitivity) should assure that flight operations can be conducted throughout the standard service volumes shown in Figures 1-1 through 1-4. DME interrogator characteristics should also assure that flight operations can be conducted throughout expanded service volumes (ESVs) at ranges out to 200 nmi and at altitudes where the path loss is no more severe than what is experienced at the worst case points of the standard service volumes.

EUROCAE ED-54 document §1.4.2 defines a range of 200 NM for DME equipment intended for upper airspace usage.

1.4.2 Range and Coverage

Two classes of DME Interrogator are permitted.

Class 1 equipment is intended for use at ranges of up to 200 nm. under suitable radio propagation and line of sight conditions.

Class 2 equipment is intended for use only in lower airspace as defined by the appropriate National Authority. Typical maximum range would be 130 nm. at a height of 18,000 ft. or above.

The maximum of 3 seconds which are required per EUROCAE ED-54 document to track the nearest DME station is not sufficient to cover the typical 40 NM of the typical low-altitude service volume as defined in RTCA DO-189 document (considering the ICAO requirement of 1 s for 10 NM). On the other hand, the maximum value of 3 minutes from ARINC 709-8 enables to cover all the typical service volumes. This value of 3 minutes is also correlated with the order of magnitude of 200 NM as required for Class 1 equipment per EUROCAE ED-54 document §1.4.2 (considering the ICAO requirement of 1 s for 10 NM).

Therefore, we recommend accepting such an interpretation of ARINC 709-8 (3 minutes to completely scan all DME stations) as one possible mean to demonstrate compliance to ETSO-C52B §3.1.1 for EUROCAE ED-54 §3.2.2 b) requirement.