



## Deviations request #98 for an ETSO approval for CS-ETSO applicable to TCAS II equipment (ETSO-C119b and ETSO-C119c) Consultation Paper

### 1. Introductory note

The hereby presented deviation requests shall be subject to public consultation, in accordance with EASA Management Board Decision No 7-2004 as amended by EASA Management Board Decision No 12-2007<sup>1</sup> products certification procedure dated 11<sup>th</sup> September 2007, 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-C119b#5/ETSO-C119c#20 Traffic Alert And Collision Avoidance System (TCAS) Airborne Equipment, TCAS II

Deviate from RTCA DO-185A and B Paragraph No 2.2.4.6.2.2.4 and 2.4.2.1.7.6 (Mode S) Power Programming by using the formula Transmit Power = -10 dB - Last Received Reply Power Level

#### Requirement:

RTCA DO-185A Paragraph 2.2.4.6.2.2.4 requires that

The transmit power level of Mode S tracking interrogations to targets (but not air-to-air coordination interrogations) shall be automatically reduced as a function of range for targets within 10 nmi as follows:

$$PT = P_{\max} + 20 \log \frac{R}{10},$$

where PT is the adjusted power level. P<sub>max</sub> is the nominal power level which is transmitted to targets at ranges of 10 nmi or more, and R is the predicted range of the target in nmi. The actual transmitted power is the lesser of PT and the limit imposed by the interference limiting procedures of subparagraph 2.2.3.6.

Air-to-air coordination interrogations shall always be transmitted at full power.

and paragraph 2.4.2.1.7.6

This test verifies that TCAS equipment adjusts the transmit power level of Mode S tracking interrogations to targets within 10 nmi of TCAS according to the criteria specified in subparagraph 2.2.4.6.2.2.4.

#### Industry:

In addition to using the power programming of MOPS paragraph 2.2.4.6.2.2.4, the considered TCAS System use a formula for determining the transmit power from the last received reply (Transmit Power = -10 dB - Last Received Reply Power Level). The

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<sup>1</sup> Cf. EASA Web: <http://easa.europa.eu/management-board/docs/management-board-meetings/2007/04/MB%20Decision%2012-2007%20amending%20the%20certification%20procedure.pdf>

lowest power level of the two computations is used for the initial interrogation in each surveillance update period to each intruder.

Thus this deviation permits, lower power interrogations based on actual radar range path loss (Transmit Power = -10 dB - Last Received Reply Power Level) instead of the higher theoretical power MOPS required interrogations, and if a reply is not received additional interrogations will be performed at a higher power level and in accordance with the MOPS interrogation limits.

Equivalent level of safety:

The proposed deviation has no negative impact on TCAS performance. The enhancement helps to conserve the power budget and therefore improve surveillance capabilities. If the lower power interrogations are not answered, the intruder is re-interrogated at a higher power in accordance with the MOPS limits.

In addition, it has been verified in flight test that this behaviour does not induce an excessive load on the 1030 MHz band: in a set of 6 116 replies to TCAS interrogations, a reply to the first interrogation was received 66% of the time. Only 8.9% of the replies were received to subsequent retry interrogations at the increased power level demonstrating the effectiveness of the power programming function. The remaining replies were received to subsequent interrogations transmitted in accordance with DO-285B § 2.2.4.6.2.2.2.

**EASA:**

Instead of using the power computed from the DO-185A or B based on distance, the deviating TCAS II equipment is reducing the transmit power as a function of the last received reply. It is recognized that this will not affect the operation of a single system, as should the interrogation power be insufficient to trigger a reply, the equipment will send a new interrogation at the nominal power.

This behaviour is acceptable considering the individual performance of the system as the message will eventually take place, either at the reduced power, or otherwise, at the DO-185A-required power.

Regarding the overall performance, the proposed deviation induces a slight increase of the 1030 MHz load as the interrogations sometimes need to be repeated. However, this has been proven to have a reduced impact, which is at least partially compensated by the lower power and therefore range of these interrogations.

We accept the deviation as alternate means to meet the requirement.