

**Deviations requests for an ETSO approval for CS-ETSO**  
**Applicable to Audio Systems**  
**Consultation Paper**

**Introductory note**

The hereby presented Deviations requests shall be subject to public consultation, in accordance with EASA Management Board Decision n°7-2004<sup>1</sup> 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 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.”

**Identification of issue**

Sennheiser and Northern Airborne Technology submits to EASA several deviation requests against CS-ETSO for their audio equipment. The applicant has received or is seeking for the related FAA TSO approval including the acceptance of the following deviations. The FAA has recently published TSO-C139 superseding the previous TSO-C50c, -C57a, C58a in one TSO already requesting RTCA DO-214 and DO-160E.

As all deviations are related to the same technical standard mentioned in different ETSO they have been combined in one deviation publication.

ETSO-C50c is addressing audio systems like amplifiers or selection panels

ETSO-C57a addresses headsets and speakers while ETSO-C58a defines the requirements for microphones.

**Deviations requests**

- (1)    **Deviation ETSO-C50c#1, - Audio Selector Panels and Amplifiers**  
         **Deviation ETSO-C57a#1 - Headsets and Speakers**  
         **Deviation ETSO-C58a#1 - Aircraft Microphones (Except Carbon)**

Deviate from § 3.1.1 to use RTCA DO-214 instead of EUROCAE ED-18/RTCA DO-170 as the Minimum Performance Standard.

See Annex 1.

- (2)    **Deviation ETSO-C50c#2, - Audio Selector Panels and Amplifiers**  
         **Deviation ETSO-C57a#2 - Headsets and Speakers**  
         **Deviation ETSO-C58a#2 - Aircraft Microphones (Except Carbon)**

Deviate from § 3.1.2 to use EUROCAE ED-14E/RTCA DO-160E instead of ED-14D/DO160D change 3 as environmental test standard.

See Annex 1.

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<sup>1</sup> Cf. EASA Web: [http://www.easa.europa.eu/doc/About\\_EASA/Manag\\_Board/2004/mb\\_decision\\_0704.pdf](http://www.easa.europa.eu/doc/About_EASA/Manag_Board/2004/mb_decision_0704.pdf)

### **(3) Deviation ETSO-C57a#3 – Headsets and Speakers**

Deviate from RTCA DO-214 2.3.8.4 and apply the Cord Connector Flexibility test only for the connector to the aircraft.

Industry:

For easier inter changeability an additional connector has been introduced between cable and the headset itself or on a kind of box introduced somewhere in the cable e.g. to adjust the volume. Other than on the connector fixed in the panel only tensile force is applied. The connector fixed in the panel has to take bending force as well. As there is no bending force at all this specific test is not applicable.

EASA:

We accept the position of the applicant and will take this point on board to clarify the requirement in future revisions of the standard to be only applicable to cases when the connector counterpart is mounted in a fixed way.

### **(4) Deviation ETSO-C50c#3 – Audio Selector Panels and Amplifiers**

Deviate from DO-214 2.8.2.7 Crosstalk

In sub-paragraph 2.8.7.2.1 Input-to-Output Crosstalk and Bleed-Through Levels:  $V_{ref}$  will be defined as the rated output level of the monitored output in lieu of the rated input.

In sub-paragraph 2.8.2.7.2 Input-to-Input Crosstalk:  $V_{ref}$  will be defined as the rated input level of the monitored input.

**Industry:**

RTCA DO-214 Section 2.8.2.7 Crosstalk:

“In subparagraphs 2.8.2.7.1, 2.8.2.7.2 and 2.8.2.7.3 the leakage or crosstalk is expressed in decibels as  $dB = 20 \log (V_{crosstalk}/V_{ref})$ . In subparagraphs 2.8.2.7.1 and 2.8.2.7.3,  $V_{ref}$  is defined as the rated input.”

The use of rated input as the reference results in inconsistency in the permitted levels of crosstalk on different outputs. The following examples illustrate this:

- (i) When a signal is applied to a microphone input with a rated input of 250 mVrms the absolute voltage level of crosstalk permitted at an output per DO-214 section 2.4.7.1 is 55 dB below 250 mVrms, or 440  $\mu$ Vrms (for Class 1a or 1b equipment). On a typical headphones output (maximum rated output 6.0 Vrms) a signal level of 440  $\mu$ Vrms, when expressed in decibels, would be:  
$$20 \log (440 \mu V / 6 V) = - 82.6 \text{ dB}$$

For a properly designed audio system a signal 80 dB below rated output level would not be audible, particularly in a noisy environment such as the cockpit of an aircraft in flight.
- (ii) Conversely for a high level radio input with a rated input of 7.75 Vrms the absolute voltage level of crosstalk permitted at an output per DO-214 section 2.4.7.1 is 55 dB below 7.75 Vrms or 14 mVrms. On a typical interphone tieline output (maximum rated output 0.5 Vrms) a signal level of 14 mVrms, when expressed in decibels, would be

$$20 \log (14 \text{ mV} / 0.5 \text{ V}) = - 31.2 \text{ dB}$$

For a properly designed audio system a signal 30 dB below rated will be audible during normal usage and would be unacceptable for most applications.

- (iii) Now consider the same interphone tieline output in example (ii) above, but instead of a high level radio input use the microphone input of example (i). The absolute voltage level of crosstalk permitted at an output is 55 dB below 250 mVrms, or 440  $\mu$ Vrms. On the interphone tieline output this equates to:

$$20 \log (440 \mu\text{V} / 0.5 \text{ V}) = - 73.2 \text{ dB}$$

Since it is the operator who is listening to the output of the equipment, if the rated input level is used to derive Vref as is currently required by DO-214, then the operator hears an inconsistent level of crosstalk isolation for different input channels (e.g. in examples (ii) and (iii), 31.2 dB for one channel, 73.2 dB for another channel).

To solve this problem, a means of assuring consistent crosstalk isolation is to use the rated output level to derive Vref.

To summarize, for subparagraph 2.8.2.7.1 Input to Output Crosstalk, Vref should be defined as the rated output level of the output being monitored. In all of the above examples, if Vref was defined as the rated output, the maximum acceptable crosstalk would be 55 dB below the rated output, which would not interfere with the intelligibility of audio on the system, and it is likely that it would not be audible to the user. More importantly, the crosstalk requirement will not vary depending on which input is used and a consistent level of safety will be assured.

For subparagraph 2.8.2.7.2 Input to Input Crosstalk, Vref is not defined by DO-214. If the examples presented above are applied to two inputs of differing rated levels, a similar inconsistency occurs with Vref defined as the rated input of the input where the signal is applied. Therefore, the most suitable definition of Vref is the rated input level of the input being monitored for the crosstalk measurement.

For example, if a receiver input having a 7.75 Vrms rated input level is supplied with an input signal, and a mic input having a 0.25 Vrms rated input level is measured, then the rated input level for the mic input should be used to derive Vref. This assures that the level of crosstalk onto the more sensitive mic input is low enough to prevent receiver audio from leaking excessively onto the mic circuit thereby assuring a greater level of safety.

**EASA** agrees to the proposal and suggest updating the specification for general clarification.

## **Annex 1      Use of updated standards**

ETSO-C50c#1, ETSO-C57a#1, ETSO-C58a#1

Use RTCA DO-214 instead of EUROCAE ED-18/RTCA DO-170.

ETSO-C50c#21, ETSO-C57a#2, ETSO-C58a#2

Use EUROCAE ED-14E/RTCA DO-160E instead of ED-14D/ DO-160D change 3.

**Industry Position:** ELOS (Equivalent Level of Safety) is provided by use of later revision of the requirement document.

**EASA:** Often there is an update to a standard available but the reference in the ETSO has not been changed. The updated documents provide more precise information to avoid misinterpretation. It is planned to update the ETSOs in the frame of the long term rulemaking program to the most accurate version.