Deviation Request ETSO-C190#1 for an ETSO approval for CS-ETSO applicable to Active Airborne Global Navigation Satellite System (GNSS) Antenna (ETSO-C190)
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 products certification procedure dated 11th 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-C190#1 Active Airborne Global Navigation Satellite System (GNSS) Antenna

2.1 Summary of Deviation

Correction of RTCA DO-301 inconsistency on the Active Sub-assembly Input Noise Temperature.

2.2 Original Requirement

RTCA DO-301 MOPS for GNSS Airborne Active Antenna Equipment for the L1 Frequency Band

2.3.2 Temperature and Altitude Tests (DO-160E, Section 4.0)

(…)

2.3.2.1 Operating Low Temperature Test

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 4.5.2, and the following requirements of this standard shall be met:

(…)

2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than 310 K over 1575.42 ± 2 MHz and less than 413 K over 1575.42 ± 8 MHz

(…)

2.3.2.2 Operating High Temperature Test

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 4.5.4, and the following requirements of this standard shall be met:

(…)

2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than 310 K over 1575.42 ± 2 MHz and less than 413 K over 1575.42 ± 8 MHz

(…)

2.3.2.3 Altitude Test

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 4.6.1, and the following requirements of this standard shall be met:

(…)

2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than 310 K over 1575.42 ± 2 MHz and less than 413 K over 1575.42 ± 8 MHz

(…)

2.3.3 Temperature Variation Test (DO-160E, Section 5.0)

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 5.0, and the following requirements of this standard shall be met:

(…)

2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than 310 K over 1575.42 ± 2 MHz and less than 413 K over 1575.42 ± 8 MHz

(…)

2.3 Industry

In the environmental tests specified in DO-301, there a number of instances where there is a requirement for monitoring of the noise temperature of the active sub-assembly. The instances are:

- Section 2.3.2.1, Operating Low Temperature Test
- Section 2.3.2.2, Operating High Temperature Test
- Section 2.3.2.3, Altitude Test
- Section 2.3.3, Temperature Variation Test

The limits are; "The input noise temperature shall be less than 310K over 1575.42 ± 2 MHz and less than 413K over 1575.42 ± 8 MHz."

Inconsistency in DO-301

The noise figure monitoring limits described above are inconsistent with the noise temperature test (DO-301, section 2.4.3.1.2) which has a noise figure limit of 4 dB for the full band 1567.42 MHz to 1583.42 MHz (1575.42 ± 8 MHz). The noise figure of 4 dB corresponds to a noise temperature of 438.4K (see equation below).

$$T = 290.\left(10^{\frac{NF}{10}} - 1\right)$$

The table below summarises the limits from the monitoring requirements and the noise temperature test.

Frequency Band (MHz)	DO-301, Section 2.3.2.1, 2.3.2.2, 2.3.2.3 and 2.3.3 Noise Temperature Monitoring Limit (K)	DO-301, section 2.4.3.1.2 Noise Temperature Test Limit (K)
1575.42 ± 2	≤ 310	≤ 438.4
1575.42 ± 8	≤ 413	≤ 438.4

Monitoring Limits Used

The noise figure of the active sub-assembly was monitored during the high and low operating temperature tests, the altitude test and the temperature variation test using the limit from the noise temperature test (4 dB) for the entire band 1575.42 ± 8.

2.4 Equivalent Level of Safety

An equivalent level of safety is provided by correcting the criteria for temperature tests with a value consistent with the detailed test procedure and with the overall active antenna performance, as shown below:

2.3.2 Temperature and Altitude Tests (DO-160E, Section 4.0)

(…)

2.3.2.1 Operating Low Temperature Test

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 4.5.2, and the following requirements of this standard shall be met:

(…)

*2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than **438.4** K over 1575.42 ± 2 MHz and less than **438.4** K over 1575.42 ± 8 MHz*

(…)

2.3.2.2 Operating High Temperature Test

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 4.5.4, and the following requirements of this standard shall be met:

(…)

*2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than **438.4** K over 1575.42 ± 2 MHz and less than **438.4** K over 1575.42 ± 8 MHz*

(…)

2.3.2.3 Altitude Test

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 4.6.1, and the following requirements of this standard shall be met:

(…)

*2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than **438.4** K over 1575.42 ± 2 MHz and less than **438.4** K over 1575.42 ± 8 MHz*

(…)

2.3.3 Temperature Variation Test (DO-160E, Section 5.0)

The equipment shall be subjected to the test conditions as specified in DO-160E, Section 5.0, and the following requirements of this standard shall be met:

(…)

*2. Active Sub-assembly Input Noise Temperature: The input noise temperature shall be less than **438.4** K over 1575.42 ± 2 MHz and less than **438.4** K over 1575.42 ± 8 MHz*

(…)

2.5 EASA position

We accept the deviation.