

Deviation Request ETSO-C166b#9 for an ETSO approval for CS-ETSO applicable to Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz) (ETSO-C166b)

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-C166b#9 Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)

2.1 Summary of Deviation

To deviate from RTCA DO-260B Test 2.4.6.1.2 – Step 2 and to test the equipment with regard to bursts only to the actual behaviour of a current (year 2015) TIS-B implementation in the US and to limit the use of the TIS function to the US.

2.2 Original Requirement

RTCA DO-260B Test 2.4.6.1.2 – Step 2. The test requires that the unit correctly receive 4 bursts of 17 extended squitters in no more than 16.7 milliseconds. This test indicates coverage of requirement 2.2.6.1.2 which states: “The ADS-B and TIS-B Message Reception functional shall deliver All OUTPUT MESSAGES to the user interface or the Report Assembly function within 2.0 milliseconds of the last message bit of the transmitted message.”

2.3 Industry

Deviation. The table below summarizes the difference between the specified test and the proposed test.

Test Metric	RTCA/DO-260B Test Requirement	Proposed Test
Peak Burst – number of messages separated by 8 μ sec	17	32
Messages Received in 16.7 ms	68	63
Gap Between peak bursts	2 msec	8.5 msec
Average Rate Per Second	Not Tested	80 Bursts / 2560 extended
Success Criteria	1 set of 4 <u>complete</u> burst received	> 98% of 800 to 1200 <u>complete</u> bursts received.

RTCA DO-260B does not specify a maximum burst performance and does not provide rationale for the burst rate performance specification implied by the existing test. The rationale is that the burst duty cycle verified by the proposed test is sufficient for the DO-317A applications implemented by the system.

1. The proposed test sufficiently tests the system for the environment.

The proposed test setup provides a burst interval approximately 10 times shorter than the FAA TIS-B ground station transmission rate and handles an average rate 2.5 times the maximum TIS-B rate.

	FAA Ground Station	Proposed Test
TIS-B ground station burst interval	1.5 milliseconds	0.128 milliseconds
TIS-B average	1000 Hz	2560 Hz

See specifications in the table below extracted from the *Surveillance and Broadcast Services Description Document SRT-047, Revision 02 October 22, 2012* that define the key transmission rate information. Flight tests have confirmed the transmit interval.

Section	Requirement
3.2.3.4	Number of messages received (TIS-B and ADS-R) received by an aircraft with a -78 dBm receiver shall not exceed 1000 1090 ES messages. This requirement impacts average rate and not burst receive rate
3.3.3.2.5	However, 1090 transmissions are randomized to minimize interference and each SBS Ground Station has a maximum 1090 transmission duty cycle of 6% (combines all 1090 TIS-B and ADS-R messages).
3.3.3.2.5	Although TIS-B transmissions are event-driven by receptions of radar/ASDE-X updates, both 1090 and UAT have configurable minimum TIS-B transmit intervals (currently set to 1.5 ms) with an added random time (up to 3 ms) appended to the minimum interval.

2. The achieved performance easily satisfies the required DO-317A update rate requirements.

The DO-317A application makes use of high update rate (1 Hz) TIS-B. The most stringent (SURF) application requires an update once every 11 seconds. Even with an unrealistic 70% loss of data

the system can still achieve an update every 11 seconds with 99% probability ($99\% = 1 - 0.7^{22}$, where 22 is the number of opportunities to hear a position squitter from a single traffic in 11 seconds). The proposed test demonstrates less than 2% loss of burst packets under these conditions.

3. **The proposed test verifies long term burst capability instead of a single burst.**

The test verifies that 98% of 800 to 1200 bursts are successfully received. The specified MOPS verification results require that only one set of 4 bursts (68 extended squitters) is successfully received.

2.4 Equivalent Level of Safety

Equivalent level of safety is maintained because the burst duty cycle verified by the proposed test demonstrates less than 2% loss of burst packets under stressful conditions, with no operational impact.

2.5 EASA position

We accept the deviation which was already approved by FAA. The usage of the TIS-B function has to be limited to the US in the installation and user manual, as the equivalent level of safety depends on the special features of the US ground segment implementation not required by international standards.