# Working Group 49

# Meeting #11

# Working Paper WG49N11-15

# SC209/WG49
# Joint meeting in Brussel

**ED 73B - New Chapter 4 organization**

Draft Proposal

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CHAPTER 4

MINIMUM PERFORMANCE SPECIFICATION UNDER
ENVIRONMENTAL TEST CONDITIONS

## 4.1 INTRODUCTION

The environmental test conditions and performance criteria described in this section provide a laboratory means of determining the overall performance characteristics of the equipment under conditions representative of those which may be encountered in actual operation.

Unless otherwise specified in this document or by the approving authority, the test procedures applicable to the determination of equipment performance under environmental test conditions are contained in EUROCAE document ED-14D, "Environmental Conditions and Test Procedures for Airborne Equipment".

These test have been reviewed and aligned with the DO181 requirements. They are summarised and presented on two tables. The first table gives the correspondance between the type of the required environmental condition, the ED14D chapter and a column specifies the relevant group of associated tests. Six group have been identified and are defined in the second table.

*The second table gives the reference to the associated requirement, the reference to the associated test procedure, and at last a column gives the test kept for the environmental conditions only.*

Some of the environmental tests contained in this section do not have to be performed unless the manufacturer wishes to qualify the equipment for that particular environmental condition; these tests are identified by the phrase "If Required". If the manufacturer wishes to qualify the equipment to these additional environmental conditions, then the "If Required" tests shall be performed.

## 4.2 Table 1 : Environmental Test Groups

| Ref chapter 4 | Environmental Conditions | ED 14 D chapters | Test Group |
|---|---|---|---|
| 4.2.1 and 4.2.2 | Temperature | 4.5 | Group 1 |
| 4.2.3 | Altitude | 4.6.1 | Group 4 |
| 4.2.4 | Decompression | 4.6.2 | If required, Group 4 |
| 4.2.5 | Overpressure Test | 4.6.3 | If required, Group 4 |
| 4.3 | Temperature Variation | 5.0 | Group 3 |
| 4.4 | Humidity | 6.0 | Group 2 |
| 4.5.1 | Operational Shocks | 7.2 | If required Group 2 |
| 4.5.2 | Crash Safety Shocks | 7.3 | Group 6 |
| 4.6 | Vibration | 8.0 | Group 3 during the tests and after Group 1 |
| 4.7 | Explosion Proofness | 9.0 | if required |
| 4.8 | Water Proofness | 10.0 | if required, Group 2 |
| 4.9 | Fluids Susceptibility | 11.0 | if required, Group 2 |
| 4.10 | Sand and Dust | 12.0 | if required, Group 2 |
| 4.11 | Fungus Resistance | 13.0 | if required, Group 2 |
| 4.12 | Salt Spray | 14.0 | if required; Group 2 |
| 4.13 | Magnetic Effect | 15.0 | Group 6 |
| 4.14 | Power Input (Normal / Abnormal Operating Conditions) | 16.0 | Group 2 |
| 4.15 | Voltage spike conducted test | 17.0 | Group 2 |
| 4.16 | Audio Frequency Conducted Susceptibility | 18.0 | Group 1 |
| 4.17 | Induced Signal Susceptibility | 19.0 | Group 1 |
| 4.18 | Radio Frequency Susceptibility (Radiated and Conducted) | 20.0 | Group 1 |
| 4.19 | Emission of Radio Frequency Energy | 21.0 | Group 6 |
| 4.20 | Lightning Induced Transient Susceptibility | 22 | Group 5 |
| 4.21 | Lightning Direct Effects | 23 | Not applicable |
| 4.22 | Icing | 24 | Not applicable |
| 4.23 | Electrostatic Discharge (ESD) | 25 | Group 1 |

Group 6: *Tests in Group 6 determine the effects of the transponder on other equipment (mounts, compass needles, explosive gasses, and other RF equipment) and therefore do not involve the transponder performance requirements of this document*

**4.3 Table 2 : Performance tests requirements during environmental tests procedures**

| EUROCAE /ED 73B | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref Chapter 3 | Ref Chapter 5 | Topic | Keep the following tests only for test on environmental conditions: | Required Test Group | | | | | |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 |
| 3.2.2 | 5.4.1.2 a | Sensitivity Variation with Frequency | Step 1 | ✓ | ✓ | ✓ | | ✓ | |
| 3.2.4 | 5.4.1.2 b through g | Sensitivity and Dynamic Range | Step 2 ,Step 3: Take MTL,Medium and -21 DBm Win 2 tests, Step 4, Step 5 , Step 6, Step 7 | ✓ | ✓ | ✓ | | ✓ | |
| 3.3.1 | 5.4.2.1 | Reply Transmission Frequency | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 3.3.3 | 5.4.2.2 | RF Peak Power Output | Step 1 Variation interrogation rate from 100 to the max<br>Proposal: same as the DO 2.3.2.2.2 plus additional modification: Take 1200 interrogations per sec or the Max for which the transponder is designed.<br>Step 2 Idem<br>See new defined steps (3 and 4) | ✓ | ✓ | | ✓ | ✓ | |
| 3.4 | 5.4.2.5 | Reply Rate Capability | Step 1 Interrogation rate at 1200 or the maximum for which the transponder is designed<br>Step 2 Duration 15<br>Step 3 , Step 4 , Step 5 ,Step 6 | ✓ | | | | | |
| 3.5 | 5.4.3.1 | Mode A/C Replies | Keep Step 1 and 2 and measure only the pulse width and position of the first and last pulse | ✓ | | | ✓ | ✓ | |
| 3.6 | 5.4.3.2 | Mode S Replies | Keep Step 1,2, and 3<br>For Step 2 measure only the first and last short pulse width and the first and last long pulse width. | ✓ | | | ✓ | ✓ | |
| 3.7 | 5.4.3.3 through 5.4.3.4 | Reply Delay and Jitter | In A/C :<br>Keep Step 1 and 2 and make the measurement at MTL+3 dB , -50 and -21 dBm.<br>In Mode S :<br>Keep Step 1 and 2 and make the measurement at MTL+3 dB , -50 and -21 dBm. | ✓ | | | | | |
| 3.8 | 5.4.4 | Side Lobe Suppression | In Mode A/C:<br>Keep Step 1, 4, 6<br>In Mode S step 1& 2 . make the test at MTL+3 dB and -21 dBm | ✓ | ✓ | | | ✓ | |
| 3.9 | 5.4.5 | Pulse Decoder Characteristics | Step1&2 make the test at MTL + 10 dB Step3,<br>Step 4 keep only Mode A and make the test at MTL+10 dB only<br>Step 5 make the test at MTL+10 dB only<br>Step7 make the test with amplitude level of MTL , -60 and -45 dBm (P1/P3=0.25 µs)<br>Step8 or 9 : make the test with amplitude level of MTL+3 , -50 and -21 dBm | ✓ | ✓ | | | ✓ | |
| 3.10 | 5.4.6 | Transponder Desensitisation and Recovery | Step 1 Make the test for 3 and 15 µs only<br>Step 2,,Step 3,Step 4, | ✓ | | | | ✓ | |
| 3.12 | 5.4.7 | Response to Interference | Step 2 Take 3 level -68, -50 and -21 dBm | ✓ | | | | | |
| 3.13 | 5.4.8 | Undesired Replies | | ✓ | | ✓ | | ✓ | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3.14 | 5.4.9.1 | Self Test and Monitors | Step1 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 3.14 | 5.4.9.2 | Squitter Monitor | On the discretion of the manufacturer | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 3.15 | 5.4.10 | Mutual Suppression Capability | No test | ✓ | | | | ✓ | |
| 3.16 | 5.4.11 | Diversity Operation | Step 1 make the test at MTL+6 dB , -50 and -21dB<br>Step 2 Modify the level difference between the two channels and take it at +6 dB (Harmonized with RTCA requirement)<br>Step 3 Modify the level difference between the two channels and take it at +6 dB (Harmonized with RTCA requirement) | ✓ | ✓ | | | ✓ | |
| 3.17.1 a | 5.4.12.1 | Fixed Direct Data | Step 1 test with AAAAAAAA and 55555555 Code Addresses only<br>Step 2<br>Step 3<br>Step 4 take only two AC Id LLLLLLLL and 33333333 | ✓ | ✓ | | | ✓ | |
| 3.17.1 b | 5.4.12.2 | Variable Direct Data | Step 1 except the invalid altitude, Step 2<br>Step 3 excepted bullet 7 and invalid altitude<br>Step 4, Step 5 | ✓ | ✓ | | | ✓ | |
| 3.17.3 | 5.4.12.3 | Standard Transaction Interfaces | Step 1: UF 24 Comm D is missing in ED 73<br>Step 2: In ED 73 clarify UF 24 for Comm B extraction.<br>Step 3<br>Remove/Clarify Step 4 from ED 73<br>Step 5 with All ones only<br>Step 6<br>Step 7 Ask DO to consider All BDS to be checked. | ✓ | ✓ | | | ✓ | |
| 3.17.4 | 5.4.12.4 | ELM Service Interfaces | Step 1 alignment is necessary<br>Step 3 | ✓ | ✓ | | | | |
| 3.17.2 b | 5.4.13 | Interface Integrity Testing | On the discretion of the manufacturer | ✓ | ✓ | | | ✓ | |
| 3.24 | 5.4.14 | Power Interruption | Amend PR =0 in ED | ✓ | ✓ | | | ✓ | |