

RTCA Special Committee 209

Working Group #1

Mode S Transponder Development and Maintenance

Meeting #2

RTCA, Washington DC  
30 May – 1 June 2007

**SC209-WG49 Action 6-6**



Review the environmental test procedures in ED-73C and make a recommendation to WG-49 during their next meeting for harmonizing the two documents.

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# 1. List of the Different Environmental conditions tests

I have "grouped" the ED 73C functional tests in order to ease the comparison between DO181 and ED 73.

Main orange: main differences between ED73B and DO 181D are underlined in "orange"

	Environmental Conditions	ED 14 D/ DO 160 D chapters	ED-73B	DO 181.D
4a	Temperature	4.5.1, 4.5.2, 4.5.3, 4.5.4	Group 1 and for short time operating test Group 2	Group 1
4b	Altitude	4.6.1	Group 4	Group 4
4c	Decompression	4.6.2	If required, Group 4	When required, group 4
	Overpressure Test	4.6.3	If required, Group 4	When required, group 4
5	Temperature Variation	5.0	Group 3	Group 3
6	Humidity	6.0	Group 2	Group 2
7	Operational Shocks		Group 2	<b>When required</b> , group 2
	Crash Safety Shocks		Group 6	<b>No Xpder tests</b> , group 6
8	Vibration	8.0	Group 1	Group 3 during Group 1 after, group 3 and 1
9	Explosion Proofness	9.0	if required	<b>No Xpder tests</b> , group 6
10	Water Proofness	10.0	if required, Group 2	When required, group 2
11	Fluids Susceptibility	11.0	if required, Group 2	When required, group 2
12	Sand and Dust	12.0	if required, Group 2	When required, group 2
13	Fungus Resistance	13.0	if required, Group 2	When required, group 2
14	Salt Spray	14.0	if required; Group 2	When required, group 2
15	Magnetic Effect	15.0	Group 6	<b>No xpder tests</b> , group 6
16	Power Input (Normal / Abnormal Operating Conditions)		Group 2	Group 3 during group 2 after, group 5 ?, group 3 and 2
17	Voltage spike conducted test		Group 2	Group 2
18	Audio Frequency Conducted Susceptibility	18.0	Group 1	Group 1
19	Induced Signal Susceptibility	19.0	Group 1	Group 1
20	Radio Frequency Susceptibility (Radiated and Conducted)	20.0	Group 1	Group 1
21	Emission of Radio Frequency Energy	21.0	Group 6	<b>No Xpder tests</b> , group 6
22	Lightning Induced Transient Susceptibility	22	Group 5	<b>Procedure Not Yet defined, none</b>
23	Lightning Direct Effects	23	Not applicable	(Not in the table 2.3.1.1)
24	Icing	24	Not applicable	(Not in the table 2.3.1.1)
25	Electrostatic Discharge (ESD)	25	Group 1	<b>(Not in the table 2.3.1.1)</b>

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*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.*

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## 2. EUROCAE ED 73B / RTCA DO 181 D Functional Test Groups

a. establish compliance with the following paragraphs of this document:

EUROCAE /ED 73B							RTCA DO 181 D											
requirement	Test	Topic	Required Test Group						Test Procedure Paragraph	DESCRIPTION	Required Environment Test Groups							
			1	2	3	4	5	6			1	2	3	4	5	6		
3.2.2	5.4.1.2 a	Sensitivity Variation with Frequency	✓	✓	✓		✓		§2.3.2.1	Receiver Characteristics	✓	✓	✓					
3.2.4	5.4.1.2 b through g	Sensitivity and Dynamic Range	✓	✓	✓		✓											
3.3.1	5.4.2.1	Reply Transmission Frequency	✓	✓	✓	✓	✓		§2.3.2.2.1	Reply Transmission Frequency	✓	✓	✓	✓				
3.3.3	5.4.2.2	RF Peak Power Output	✓	✓		✓	✓		§2.3.2.2.2	RF Peak Power Output	✓	✓		✓				
3.4	5.4.2.5	Reply Rate Capability	✓						§2.3.2.2.3	Reply Rate Capability	✓							
3.5	5.4.3.1	Mode A/C Replies	✓			✓	✓		§2.3.2.3	Reply Pulse Characteristic	✓							
3.6	5.4.3.2	Mode S Replies				✓	✓											
3.7	5.4.3.3 through 5.4.3.4	Reply Delay and Jitter	✓															
3.8	5.4.4	Side Lobe Suppression	✓	✓			✓		§2.3.2.4	Side Lobe Suppression	✓	✓						
3.9	5.4.5	Pulse Decoder Characteristics	✓	✓			✓		§2.3.2.5	Pulse Decoder Characteristic	✓	✓						
3.10	5.4.6	Transponder Desensitisation and Recovery	✓				✓		§2.3.2.6	Transponder Recovery & Desens.	✓							
3.12	5.4.7	Response to Interference	✓						§2.3.2.7	Standard Interference Pulse	✓							
3.13	5.4.8	Undesired Replies	✓		✓		✓		§2.3.2.8	Undesired Replies	✓		✓		✓			
3.14	5.4.9.1	Self Test and Monitors	✓	✓	✓	✓	✓		§2.3.2.9	Self-Test and Monitors	✓	✓	✓	✓	✓			
3.14	5.4.9.2	Squitter Monitor	✓	✓	✓	✓	✓											
3.15	5.4.10	Mutual Suppression Capability	✓				✓			???								
3.16	5.4.11	Diversity Operation	✓	✓			✓		§2.3.2.10	Diversity Operation	✓	✓						
3.17.1 a	5.4.12.1	Fixed Direct Data	✓	✓			✓		§2.3.2.11	Data Handling & Interfaces	✓	✓						
3.17.1 b	5.4.12.2	Variable Direct Data	✓	✓			✓											
3.17.3	5.4.12.3	Standard Transaction Interfaces	✓	✓			✓											
3.17.4	5.4.12.4	ELM Service Interfaces	✓	✓			✓											
3.17.2 b	5.4.13	Interface Integrity Testing	✓	✓			✓											
3.24	5.4.14	Power Interruption	✓	✓			✓		§2.3.2.12	Restoration of Power	✓	✓			✓			

b. ensure that mechanical devices operate satisfactorily.

### 3. Conclusion/Proposal

#### Item 8: Vibration Test

During vibration tests, group 1 functional test cannot be realized. Therefore I propose to support DO 181D position. That is Group 3 during the test and Group 1 once the test has been realized in order to check that vibrations did not impact the transponder functions~~nothing has been broken after the vibration application.~~

⇒ ED73C should be harmonized with DO181D (group 3 during, group 1 after)

#### Item 22: Lightning Induced Transient Susceptibility

The Group 5 could be probably limited to Sensitivity tests, power and frequency Group 5 in ED 73 B is associated with Lightning induced transient susceptibility. Not yet defined in DO 181D, Group 5 in DO181 is not used.

⇒ ED 73C: Limit the Group 5 to Sensitivity, power and frequency tests

⇒ DO181 should be harmonized with ED73C

#### Item 25 ESD:

Propose to test only Fixed Direct Data and, Variable Direct Data since this test is dedicated to ~~seems to support the~~ HMI (injection de static par l'opérateur)

⇒ ED 73C: Limit the test to Fixed Direct Data and Variable Direct Data

⇒ DO 181D should be harmonized with ED73C