

RTCA Special Committee 209
ATCRBS / Mode S Transponder
Meeting #4

Honeywell, Olathe KS
18 – 19 October 2006

Revision to SC209-WP03-07
Identification of RTCA-DO-181C Test Procedures that are Candidates
for Increasing the Number of Test Points
Revision #1 was accomplished during Meeting #4 and the changes are marked with
annotations on each suggested change and highlighted in yellow.

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SUMMARY

At SC209 meeting 2, while discussing changes to test procedures, a suggestion was made to increase the number of test points for applicable test procedures. The purpose of this working paper is to identify test procedures that are candidates for discussion on this matter.

This paper is a revision to SC209-WP03-07.

As part of the revised test procedures to be included in the updated transponder MOPS (RTCA DO-181D), it has been decided to increase the number of test points for certain test procedures in order to set the conditions for a more comprehensive evaluation of transponder performance. The draft RTCA MOPS DO-181D-vo-5 already includes some of these changes. The purpose of this working paper is to identify additional test procedures that are candidates for similar changes.

Detailed Test Procedures

2.4.2.1 Receiver Characteristics (Paragraph 2.2.2)

Step 1 Sensitivity Variation with Frequency **(Subparagraph 2.2.2.2)**

Comment: There is some ambiguity as to what RF frequencies will be tested. Need to test 1029.8, 1030.0 and 1030.2 as a minimum so that the sensitivity at the end points can be compared to that at 1030.0 MHz.

Recommendation: Change wording to clearly include 1030.0 MHz. “Vary the RF signal frequency over the range 1029.8 to 1030.2 MHz. Use a frequency increment that includes 1030.0 MHz.” [AGREED and Implemented]

Step 3 ATCRBS and ATCRBS/Mode S All-Call Dynamic Range **(Subparagraph 2.2.2.4 f)**

Comment: This test currently uses 5 dB Steps.

Recommendation: Change to “1 dB intervals”. [NOT AGREED TO]

Step 7 Mode S Dynamic Range (Subparagraph 2.2.2.4 c)

Comment: This test currently uses 5 dB Steps.

Recommendation: Change to “use 1 dB steps”. [NOT AGREED TO]

2.4.2.3.3 Mode S Replies (Subparagraph 2.2.4.2)

Step 7 Mode S Reply Delay and Jitter (Subparagraph 2.2.4.2.5 a)

Comment: This test calls for varying the interrogation power between 3 dB above MTL and -21 dBm but does not specify the power increment to use.

Recommendation: Change to 1 dB steps. "... when the signal level is varied between 3 dB above MTL and -21 dBm **in 1 dB steps**". [NOT AGREED TO]

Step 8 ATCRBS/Mode S All-Call Reply Delay and Jitter (Subparagraph 2.2.4.2.5 b)

Comment: As in step 7, this test calls for varying the interrogation power between 3 dB above MTL and -21 dBm but does not specify the power increment to use.

Recommendation: Change to 1 dB steps. "... when the signal level is varied between 3 dB above MTL and -21 dBm **in 1 dB steps**". [NOT AGREED TO]

2.4.2.4 Side Lobe Suppression (Paragraph 2.2.5 and Subparagraph 2.2.8.5)

Step 1 SLS Decoding [Subparagraphs 2.2.5.1 a (1) and (3), 2.2.5.1 b and 2.2.8.5]

Comment: The test procedure calls for varying the P1-P2 spacing over the range 1.0 to 3.0 microseconds, but does not specify an increment. The must suppress range is from 1.85 to 2.15 microseconds and the must not suppress range is outside 2.0 ± 0.7 microseconds.

Recommendation: Require a minimum 50 nanosecond increment. "As the P1-P2 spacing is varied over 1.0 to 3.0 microseconds (**with a minimum 0.05 microsecond step**), ...". [NOT AGREED TO]

Step 2 SLS Dynamic Range [Subparagraphs 2.2.5.1 a (2) and 2.2.5.1 c]

Step 3 SLS Pulse Ratio (Subparagraph 2.2.5.1 b)

Step 4 SLS Pulse Ratio (Subparagraph 2.2.5.1 a and b)

Comment: Each test step measures the SLS characteristics at 4 power levels (MTL + 3dB, -60 dBm, -40 dBm and -21 dBm). The 4 power levels currently used to determine the SLS decoding and ratio characteristics are sufficient.

Recommendation: Not a candidate for 1-dB steps. Do not change the test RF signal levels. [ACCEPTED and reversed previous change]

2.4.2.5 Pulse Decoder Characteristics (Paragraph 2.2.6) Equipment Required

Step 1 Pulse Level Tolerances, ATCRBS/Mode S All-Call (Subparagraph 2.2.6.1.1)

and

Step 2 Pulse Level Tolerances, ATCRBS-Only All-Call (Subparagraph 2.2.6.1.2)

Comment: These tests vary the relative power level of P4 between -10 and 0 dB with respect to P3 but do not define a power increment. Also, the use of 4 base power levels for testing these tolerances is sufficient. However the initial power level should be set to 1 dB above MTL instead of 10 dB above MTL (2.2.6.1.1).

Recommendation: Initially set the input power level to 1 dB above MTL instead of 10 dB above MTL and Require a 1 dB step. “Interrogate at the standard rate and at an input level 1 dB above MTL.” “Vary the level of the P4 pulse between -10 and 0 dB with respect to P3 in 1 dB steps.” [DELAYED UNTIL NEXT MEETING WITH RECOMMENDATION TO TEST REQUIREMENT PARAGRAPHS “A” AND “B” SEPARATELY]

Step 7 Short Pulse Rejection, ATCRBS-Type Interrogations (Subparagraph 2.2.6.3 c)

Comment: This test has been modified to use 1 dB steps in the draft DO-181D. The purpose of the test is to verify that the transponder rejects pulses that are too narrow (P1 and P3) by testing the acceptance of interrogations while independently varying the width of the P1 and P3 pulses. The original test power range from 1 dB above MTL to -45 dBm in 5 dB steps is sufficient.

The test step calls for varying the pulse duration between 0.2 and 0.7 microseconds, but does not specify a step value. Since the requirement is that the transponder reject pulse widths less than 0.3 microseconds, it would be a benefit to specify using 50 nanosecond steps (at least between 0.2 and 0.3) because that will provide 2 data points less than 0.3 microseconds.

Recommendation: Restore the test to the original use of 5 dB steps. Specify using 0.05 microsecond steps, or at least use 0.2, 0.25, and 0.3 and

0.1 microsecond steps thereafter. [ACCEPTED and reversed previous change]

Step 8 Sync Phase Reversal Position Tolerance (From P1) (Subparagraph 2.2.6.4)

Step 9 Sync Phase Reversal Position Tolerance (From P6) (Subparagraph 2.2.6.4)

Comment: These two tests are really the same test just with a different point of reference for positioning the sync phase reversal. Since there is a requirement that the transponder reject an interrogation if the sync phase reversal is detected outside the interval of nominal ± 200 nanoseconds, the test procedures need to expand the test range to include at least one point outside this range on each end. The test procedure should also define a test step value. Also, the title of step 8 should be “From P2” instead of “From P1”.

Recommendation: Change Step 8 title to “(From P2)”. Change test range and define a position increment. “P6 sync phase reversal transient by 250 nanoseconds from the nominal 2.75 (or 1.25) microseconds in 50 nanosecond steps.” [ACCEPTED and implemented]

2.4.2.7 Response to Interference (Paragraph 2.2.8)

Comment: There are multiple test steps that have been modified to use 1 dB steps in the draft DO-181D. The purpose of these tests is to test the transponders response to various types of interference. The basis of these tests is to inject interference at defined amplitudes that are relative to the test signal and vary the position or frequency of the interference. It is important to perform these tests at a range of power levels, but in this case the use of 5-dB steps provides an adequate level of testing.

Recommendation: Restore the test steps in 2.4.2.7 to use the original 5 dB steps. [ACCEPTED and reversed previous change]

2.4.2.11 Diversity Operation (Subparagraphs 2.2.12 and 2.2.20 d)

Step 1 Single Channel Test (Subparagraphs 2.2.12.3 and 2.2.12.4)

Comment: Currently this test runs at 1 power level and a subset of the test is repeated at 2 other power levels. If the test was changed to use more interrogation power levels there would be a better assessment of the reply delay difference between the two channels.

Step 2 Selection Test (Subparagraph 2.2.12.1. b)

Comment: Currently the test uses one relative power level between the two channels and tests that based on a 3-dB difference in amplitude, the channel with the stronger interrogation is selected. Should this test include more power levels?

Step 3 Delay-Selection Test (Subparagraph 2.2.12.2)

Comment: Currently the test uses one delay position (0.375 microseconds). If the test was expanded to step through a range of delay positions (25 nanosecond steps?), there would be a more comprehensive measure channel selection based on delay criteria.