

RTCA Special Committee 209

ATCRBS / Mode S Transponder MOPs Maintenance

**In Joint Teleconference and WebEx Session
9 December 2010
9:00 am EST (New York)**

**Test Results for Rockwell Collins, Inc., Mode-S Transponder
Acceptance of Mode-S Interrogations Generated with
Direct Digital Synthesis (I & Q Modulation)**

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SUMMARY

The Co-Chairmen RTCA SC-209 and EUROCAE WG-49 have requested that all Mode-S Transponder vendors test their transponders in accordance with SC-209/WG49-WP12-24R1.

This document presents the preliminary results of such testing performed on various Mode-S Transponder products maintained by Rockwell Collins, Inc.

1. **Introduction:**

All test required by SC-209/WG49-WP12-24R1 were performed using Vector Signal Generators, Aeroflex IFR Interrogator Equipment, Associated RF Couplers and Attenuators, and monitoring equipment.

2. **Transponder Results:**

The following subparagraphs present the results of testing the primary Mode-S Transponder Products maintained by Rockwell Collins, Inc.

- a. **TDR-94D** (CPN: 622-9210-410: Heavy General Aviation / Regional)

The TDR-94D passed all required tests with no issues being observed during the testing.

- b. **TPR-901** (CPN: 822-1338-004: Air Transport)

The TPR-901 passed all required tests with no issues being observed during the testing.

- c. **TSS-4100** (CPN: 822-2132-001: Integrated System, Air Transport)

The TSS-4100 passed all required tests with no issues being observed during the testing.

- d. **TPR-720** (CPN: 622-7878-201: Air Transport)

The TPR-720 passed all required tests with the following exceptions being observed:

- (1). Step 9:

P6 @ MTL + 3 dBm = -73 dBm

P5 @ P6 - 12 dBm = -85 dBm

Reply rate of the TPR-720 was only **95%** when it should be a minimum of **99%**.

- (2). Step 10:

P6 @ -63 dBm

P5 @ -75 dBm

Reply rate of the TPR-720 was only **97%** when it should be a minimum of **99%**.

It should be noted that the TPR-720 UUT had not been re-aligned for SLS performance prior to running the test procedure above. Considering that the test failure is within 2% of the required performance in both of the failed steps, it is most likely that a properly aligned UUT will pass the test. Rockwell Collins, Inc., wants to run the test using an Aeroflex 45TS prior to performing an alignment of the UUT.

It should also be noted that the TPR-720 is the oldest Mode-S Transponder in the Rockwell Collins, Inc., product line. As such, it is being phased out through most of the world, and definitely will be phased out if ADS-B Out is implemented progressively in the world. Taking these considerations in mind, the point failures exhibited by the UUT should not present any issues to the operational airspace as most interrogators world wide cannot generate the P5 SLS pulse.

3. **TCAS Results:**

Review of the interrogation transmitted by all of Rockwell Collins, Inc., TCAS products indicates that all such products are functioning well within the requirements of the SARPs and MOPS and are not inducing any issues in regards to the type of DPSK modulation implemented.

4. **Conclusion:**

Based on the above, Rockwell Collins, Inc., Mode-S Transponder and TCAS products are functioning within the requirements of the SARPs, MOPS, and SC-209/WG49-WP12-24R1 and should present no issues to the operational airspace.

Rockwell Collins, Inc., will repeat the testing with an Aeroflex 45TS upon availability, re-align the TPR-720 as necessary, repeat testing and provide further feedback as deemed necessary.