

Appendix F to Part 43 -- ATC Transponder Tests and Inspections

The ATC transponder tests required by §91.413 of this chapter may be conducted using a bench check or portable test equipment and must meet the requirements prescribed in paragraphs (a) through (j) of this appendix. If portable test equipment with appropriate coupling to the aircraft antenna system is used, operate the test equipment for ATCRBS transponders at a nominal rate of 235 interrogations per second to avoid possible ATCRBS interference. Operate the test equipment at a nominal rate of 50 Mode S interrogations per second for Mode S. An additional 3 dB loss is allowed to compensate for antenna coupling errors during receiver sensitivity measurements conducted in accordance with paragraph (c)(1) when using portable test equipment.

(a) Radio Reply Frequency:

- (1) For all classes of ATCRBS transponders, interrogate the transponder and verify that the reply frequency is 1090 ± 3 Megahertz (MHz).
- (2) For classes 1B, 2B, and 3B Mode S transponders, interrogate the transponder and verify that the reply frequency is 1090 ± 3 MHz.
- (3) For classes 1B, 2B, and 3B Mode S transponders that incorporate the optional 1090 ± 1 MHz reply frequency, interrogate the transponder and verify that the reply frequency is correct.
- (4) For classes 1A, 2A, 3A, and 4 Mode S transponders, interrogate the transponder and verify that the reply frequency is 1090 ± 1 MHz.

(b) Suppression: When Classes 1B and 2B ATCRBS Transponders, or Classes 1B, 2B, and 3B Mode S transponders are interrogated Mode 3/A at an interrogation rate between 230 and 1,000 interrogations per second; or when Classes 1A and 2A ATCRBS Transponders, or Classes 1B, 2A, 3A, and 4 Mode S transponders are interrogated at a rate between 230 and 1,200 Mode 3/A interrogations per second:

- (1) Verify that the transponder does not respond to more than 1 percent of ATCRBS interrogations when the amplitude of P2 pulse is equal to the P1 pulse.
- (2) Verify that the transponder replies to at least 90 percent of ATCRBS interrogations when the amplitude of the P2 pulse is 9 dB less than the P1 pulse. If the test is conducted with a radiated test signal, the interrogation rate shall be 235 ± 5 interrogations per second unless a higher rate has been approved for the test equipment used at that location.

(c) Receiver Sensitivity:

- (1) Verify that for any class of ATCRBS Transponder, the receiver minimum triggering level (MTL) of the system is -73 ± 4 dbm, or that for any class of Mode S transponder the receiver MTL for Mode S format (P6 type) interrogations is -74 ± 3 dbm by use of a test set either:
 - (i) Connected to the antenna end of the transmission line;
 - (ii) Connected to the antenna terminal of the transponder with a correction for transmission line loss; or
 - (iii) Utilized radiated signal.
 - (2) Verify that the difference in Mode 3/A and Mode C receiver sensitivity does not exceed 1 db for either any class of ATCRBS transponder or any class of Mode S transponder.
- (d) Radio Frequency (RF) Peak Output Power:
- (1) Verify that the transponder RF output power is within specifications for the class of transponder. Use the same conditions as described in (c)(1)(i), (ii), and (iii) above.
 - (i) For Class 1A and 2A ATCRBS transponders, verify that the minimum RF peak output power is at least 21.0 dbw (125 watts).
 - (ii) For Class 1B and 2B ATCRBS Transponders, verify that the minimum RF peak output power is at least 18.5 dbw (70 watts).
 - (iii) For Class 1A, 2A, 3A, and 4 and those Class 1B, 2B, and 3B Mode S transponders that include the optional high RF peak output power, verify that the minimum RF peak output power is at least 21.0 dbw (125 watts).
 - (iv) For Classes 1B, 2B, and 3B Mode S transponders, verify that the minimum RF peak output power is at least 18.5 dbw (70 watts).
 - (v) For any class of ATCRBS or any class of Mode S transponders, verify that the maximum RF peak output power does not exceed 27.0 dbw (500 watts).
- (e) Mode S Diversity Transmission Channel Isolation: For any class of Mode S transponder that incorporates diversity operation, verify that the RF peak output power transmitted from the selected antenna exceeds the power transmitted from the nonselected antenna by at least 20 db.
- (f) Mode S Address: Interrogate the Mode S transponder and verify that it replies only to its assigned address. Use the correct address and at least two incorrect

addresses. The interrogations should be made at a nominal rate of 50 interrogations per second.

- (g) Mode S Formats: Interrogate the Mode S transponder with uplink formats (UF) for which it is equipped and verify that the replies are made in the correct format. Use the surveillance formats UF=4 and 5. Verify that the altitude reported in the replies to UF=4 are the same as that reported in a valid ATCRBS Mode C reply. Verify that the identity reported in the replies to UF=5 are the same as that reported in a valid ATCRBS Mode 3/A reply. If the transponder is so equipped, use the communication formats UF=20, 21, and 24.
- (h) Mode S All-Call Interrogations: Interrogate the Mode S transponder with the Mode S-only all-call format UF=11, and the ATCRBS/Mode S all-call formats (1.6 microsecond P4 pulse) and verify that the correct address and capability are reported in the replies (downlink format DF=11).
- (i) ATCRBS-Only All-Call Interrogation: Interrogate the Mode S transponder with the ATCRBS-only all-call interrogation (0.8 microsecond P4 pulse) and verify that no reply is generated.
- (j) Squitter: Verify that the Mode S transponder generates a correct squitter approximately once per second.
- (k) Records: Comply with the provisions of §43.9 of this chapter as to content, form, and disposition of the records.

Note: The tests in (e) through (j) apply only to Mode S transponders.

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