

Title 14—Aeronautics and Space  
CHAPTER I—FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

[Docket No. 10955; Amdt. Nos. 43-18; 91-110]

PART 43—MAINTENANCE, PREVENTIVE MAINTENANCE, REBUILDING AND ALTERATION

PART 91—AIR TRAFFIC AND GENERAL OPERATING RULES

ATC Transponder Tests and Inspections

The purpose of these amendments is to modify the test and inspection requirements of § 91.177 and Appendix F of Part 43 of the Federal Aviation Regulations.

These amendments are based upon amendments 43-17 and 91-107, published in the FEDERAL REGISTER on December 27, 1972 (37 FR 28495). The regulations concerning test and inspection requirements for transponders were adopted as additions to the amendments establishing standards for Airborne ATC Transponder Equipment arising from a Notice of Proposed Rule Making (Notice 71-10) issued on March 22, 1971, and published in the FEDERAL REGISTER on March 30, 1971 (36 FR 5853). Since the test and inspection regulations were adopted without prior notice, comments were solicited until March 27, 1973, to determine the need for further amendments to the regulations. Numerous comments have been received in response to this request and except for those indicating agreement with the present regulations, the disposition of the comments is discussed hereinafter.

Many of the commentators expressed the opinion that yearly tests and inspections are unnecessary because they believe that Air Traffic Control (ATC) is continuously providing inspection for their transponders during the normal interrogation and reply. They believed that the radar controller can determine and communicate to the pilot when a transponder needs calibration so that if no objection or comment is received from the controller the pilot can assume the transponder is functioning satisfactorily.

The FAA does not agree with the contention that the ATC can determine the calibration or proper functioning of a transponder. In the past, when air traffic control procedures were performed manually and during periods of low air traffic density, it was possible for air traffic controllers to assist in performing checks on transponder performance. Today, however, the automatic system utilizes computer equipment which either accepts or rejects transponder replies

without any communication with the pilot. Thus, to ensure proper operation of transponders, it has become necessary to require independent checks of transponder signals.

Not only may the controller be unaware that a particular transponder is not performing within specification, since the signal may be rejected by the ARTS computer as being invalid, but, if the transponder operation has improper side lobe suppression it may generate extraneous replies which garble other transponder signals and prevent the computer from presenting to the controller valid data from properly operating transponders. Subtle degradation in transponder performance and certain other transponder malfunctions are not detectable by controllers under even the most favorable circumstances.

Many respondents also objected to the yearly tests as being counter-productive. They believed that the technical complexity of the tests would require removal and reinstallation of the transponder with the possibility that the transponder could be damaged. Several commentators also questioned the reliability of some repair stations. It was further pointed out by many commentators that the relationship between the current number of installed transponders (more than 60,000) to the number of repair stations presently able to perform transponder maintenance (523) would create a situation which would prevent an orderly schedule for the required inspections and tests. One commentator pointed out that, if the specific deviations shown in the 504 transponders tested by Lincoln Laboratory and reported in FAA Report No. FAA RD-72-30 are representative of the transponders presently in use, then over 60,000 deviations from specifications would be encountered in the first annual test. Several of the commentators suggested that, to avoid the anticipated overload on the repair facilities, the inspections and tests be conducted every two years instead of every year.

Based on these comments and on further review, the FAA has determined that the compliance date in § 91.177 should be extended from January 1, 1974, to January 1, 1976. This will provide lead time for new repair stations to obtain the necessary certification to perform the tests. In response to further comments, the rule is also amended to expand the time interval for the periodic tests and inspections of transponders from every year to every two years in order to allow complete Mode C checkout during altimeter checks.

Many of the commentators, concerned that it would be necessary to remove the transponder from the aircraft to accomplish the tests, argued that the removal and reinstallation time and cost would be burdensome and that there would be a chance of damage to a previously operating transponder. They were also concerned with the impracticality of measuring the transponder transmitter power output at the end of the transmission line. They believed this test would require additional costs because of the difficult accessibility of these lines in some installations.

The purpose of the tests and inspections is to ensure the use of properly operating transponders in the National Airspace System, and the FAA believes after further consideration that the use of portable ramp test sets would allow adequate testing of the installed transponder. Presently available portable test equipment would not allow testing of all the parameters presently specified in Appendix F of Part 43. However, after further consideration of the parameters presently specified, the FAA has determined that adequate testing of the transponders can be accomplished in the aircraft without conducting the tests for reply transmission characteristics, framing pulse, reply codes, reply pulse width, and transmitter power output. These tests, set forth in paragraph (b), (c), (d), and (g) of Appendix F to Part 43, have, therefore, been deleted.

One commentator suggested that the interrogation rate for the suppression test be specified. The FAA agrees and has amended the suppression test to specify an interrogation rate of 235 per second with replies not to exceed 3 per second when  $P_1$  equals  $P_2$ . This nominal pulse repetition rate of 235 will eliminate the interference caused by maintenance testing of transponders when the pulse repetition rate of the test signal is equal to or harmonically related to the pulse repetition rate of the ATC radar. In addition, the response has been changed to 211 replies per second when the amplitude of the  $P_1$  pulse is 9db less than the  $P_2$  pulse. The response rate is reduced from the previous rate of 450 per second to prevent harmful interference and reduce congestion on the ATC radar.

The requirement of  $-73 \pm 4$ dbm for receiver sensitivity remains unchanged. However, an additional 3dbm tolerance is allowed to compensate for coupling errors associated with portable test equipment. In addition, consistent with the use of portable test equipment, an option

(As published in the Federal Register [38 F.R. 35441] on December 28, 1973)

is provided in testing for receiver sensitivity to allow measurements by radiated signal testing or by direct connection at either end of the antenna transmission line.

The FAA does not agree with several commentators who contended that the tests would serve no useful purpose since a transponder could fall on the next flight or next day after an inspection. In the tests performed by the Lincoln Laboratory, 31 of the 549 transponders were inoperative and a significant number of the transponders failed to meet some of the parameters tested. More significantly, however, the operators appeared to be unaware that their transponders were not functioning properly. The FAA believes that this indicates that a significant number of transponder deficiencies are related to a lack of maintenance and a gradual degradation of transponder performance which might not be readily discerned in normal operation. The FAA therefore believes that periodic tests are necessary to assure adequate operation for use in the National Airspace System.

Several commentators believed that since their transponders were TSO'd future testing would be unnecessary. However, the TSO specifications and the operational specifications, although complementary, are not the same. As with any electronic device whether solid state or not, performance may deteriorate and may be subtle and not readily discernible. Therefore, the operational testing specified in § 91.177 is necessary for continued integrity of the system.

Interested persons have been afforded an opportunity to participate in the making of these amendments and due

consideration has been given to all matter presented.

Since these amendments relieve a restriction and extend a compliance date and do not impose an additional burden on affected persons, good cause exists for making them effective in less than 30 days.

These amendments are made under the authority of sections 313(a), 601, 603, 604, and 605 of the Federal Aviation Act of 1958 (49 U.S.C. 1354(a), 1421, 1423, 1424, and 1425), and section 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)).

In consideration of the foregoing, Parts 43 and 91 of the Federal Aviation Regulations are amended as follows, effective December 31, 1973.

1. Appendix F of Part 43 is amended to read as follows:

**Appendix F—ATC Transponder Tests and Inspections**

Each person performing the ATC transponder tests required by § 91.177 shall comply with the following: (If portable test equipment with appropriate coupling to the aircraft antenna system is used, operate the test equipment at a nominal rate of 235 interrogations per second to avoid possible ATCRBS interference. An additional 3db tolerance is permitted to compensate for antenna coupling errors during receiver sensitivity measurements conducted in accordance with paragraph (c)(1) when using portable test equipment.)

(a) Reply radio frequency:

(1) Interrogate the transponder and verify that the reply frequency is  $1090 \pm 3$  MHz.

(b) Suppression:

(1) Verify that the transponder response to mode 3/A interrogations does not exceed 3 replies per second when the amplitude of the P<sub>2</sub> pulse is equal to the P<sub>1</sub> pulse and the transponder is interrogated at a pulse rep-

etition rate of 235 per second.

(2) Verify that the transponder response to mode 3/A interrogations is at least 211 replies per second when the amplitude of the P<sub>2</sub> pulse is 9db less than the P<sub>1</sub> pulse and the transponder is interrogated at a pulse repetition rate of 335 per second.

(c) Receiver sensitivity:

(1) Verify that receiver sensitivity of the system is  $-73 \pm 4$ dbm by use of a test set—

(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) Utilizing a radiated signal.

(2) Verify that the difference in mode 3/A and mode C receiver sensitivity does not exceed 1db.

(d) Records:

Comply with the provisions of § 43.9 of this chapter as to content, form, and disposition of the records.

2. Section 91.177 is amended by amending paragraph (a) to read as follows:

**§ 91.177 ATC Transponder Tests and Inspections.**

(a) After January 1, 1976, no person may use an ATC transponder that is specified in §§ 91.24(a), 121.345(c), 127.123(b), or 135.143(c) of this chapter, unless, within the preceding 24 calendar months, that ATC transponder has been tested and inspected and found to comply with Appendix F of Part 43 of this chapter.

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Issued in Washington, D.C., on December 19, 1973.

ALEXANDER P. BUTTERFIELD,  
Administrator.