See correction

Advance copy pending issuance of revised pages for FAR Parts 37, 43, 91, 121, 127, and 135

Title 14—AERONAUTICS AND SPACE

Chapter I—Federal Aviation Administration, Department of Transportation

[Docket No. 10955, Amdt. 37-35, 43-17, 91-107, 121-101, 127-31, 135-33]

AIRBORNE ATC TRANSPONDER EQUIPMENT

The purpose of these amendments to Parts 37, 43, 91, 121, 127, and 135 of the Federal Aviation Regulations is to provide new standards for Airborne ATC Transponder Equipment and to require that transponders in aircraft meet TSO standards.

These amendments are based on 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 F.R. 5853). Numerous comments were received in response to Notice 71-10 and the relevant comments are discussed below. Based upon these comments and upon further consideration by the FAA, a number of changes have been made to the proposed rule.

Interested persons have been afforded an opportunity to participate in the making of these amendments, and due consideration has been given to all relevant matter presented. Except as modified by the following discussion, the reasons for these amendments are those set forth in the Notice.

A number of comments objected to the use of the TSO system for the approval of Class 2A and 2B ATC transponders. The commentators assert that the TSO system is primarily intended to provide approvals for equipment for air carrier operations, that it is too time consuming and costly for equipment intended to be used on general aviation aircraft, and that alternative approval methods should be allowed. It should be noted that under § 21.305 of the Federal Aviation Regulations an appliance may be approved under the TSO system, or as part of the aircraft design under the aircraft type certification procedures, or in any other manner approved by the Administrator. The same methods of approval are permitted under the proposal and this amendment. The FAA does not believe that the methods suggested by the commentators would provide the production quality control and FAA surveillance that is necessary to assure that the transponders meet the proposed standards which are required for FAA approval.

In response to a number of comments that the proposed TSO data requirements in paragraph (d)(1)(iv) of § 37.180 can be interpreted as requiring a full compliance test program on each production unit, the subparagraph has been revised to make it clear that the equipment data sheet must specify the actual performance of equipment of a type rather than of each individual unit. In addition paragraph (d)(2) has been revised to include, by reference, the manufacturer's operating instructions and equipment limitations in the information that must be furnished with each article.

A number of comments objected to the implementation dates specified in the notice. All but one of those commentators maintained that the proposed effective dates would not provide a reasonable service life for the equipment already in service or in production, and they recommended a postponement in the implementation dates for periods varying from a few years to an indefinite period of time. The other commentator recommended that the implementation date for newly installed equipment in air carrier aircraft be the same as the implementation date for the rules that will result from notice of proposed rule making No. 69-9. Based on this comment and upon further consideration the implementation dates have been changed to January 1, 1974, for new equipment installations and July 1, 1975, for all equipment installations in order to make them consistent with the dates proposed in Notice 69-9, as supplemented by Notice 72-12.

In response to the request in Notice 71-10 for comments as to the need for the proposed low altitude transponder category, numerous comments were received recommending its retention. Several of the commentators also suggested that the utilization altitude be tied to an operational air traffic control altitude presently in use, such as the 18,000-foot altitude used to define positive control areas. In support of the retention of a low alti-

(As published in the Federal Register [37 F.R. 28495] on December 27, 1972)

tude transponder category, the commentators estimated variously that high altitude transponders are from 5 percent to 82 percent more costly than low altitude transponders, and that it would be unreasonable to require a high altitude transponder on aircraft which would only operate above the altitude under extreme weather or emergency conditions. Based on these comments, the amendment retains the provisions for a low altitude transponder category. The FAA does not agree with the suggestion that the altitude limit for use of low altitude transponders be tied to defined positive control areas because of equipment considerations.

One commentator recommended the elimination of the high altitude transponder category on the ground that there is no technical justification for requiring a higher power output for transponders in aircraft operating at altitudes above 15,000 feet. The FAA does not agree. A power output, greater than that required in the low altitude transponder, provides assurance that aircraft that operate at high altitude, and at great horizontal distance from the receiving station will show up on the air traffic controller's scope.

A comment was received suggesting that air traffic controllers should be instructed as to the difference in capabilities of low and high altitude transponders, and that pilots should be required to inform air traffic controllers as to the type of transponder installed on his aircraft. However, since the proposed operating rules require the use of a transponder appropriate to the type of operations intended, the FAA does not believe that there is a need to require pilots to inform air traffic controllers as suggested.

The FAA does not agree with a suggestion made by several commentators that the environmental test requirements be revised to include Option C of Part 1 in section III of RTCA Document DO-144. The RTCA option suggests that the manufacturer, as a minimum, should state the range of temperature and altitude over which his equipment is capable of operating. Proposed § 37.180(a)(2) (renumbered as paragraph (a)(3) in this amendment) specifies these conditions and, in addition, humidity, shock, vibration, and power input voltage. Due to the wide range of environments in which general aviation aircraft operate, the minimum environmental conditions specified in Option C of Part 1 of section III of RTCA Document DO-144 are insufficient to insure the required level of reliability.

One commentator requested that operators certificated under Part 135 be permitted to use any class of complying ATC transponders since certain operating limitations placed on Part 135 operators are not applicable to air carriers. The FAA does not agree. The limitations mentioned by the commentator are not related to the capability of the type of transponder used, and the reasons which justify the proposed requirement for air carriers are equally applicable to Part 135 operators.

In response to a suggestion that provisions be made for the continued operation of transponders approved under TSO-C74 and TSO-C74a, the proposed operating rules have been revised to permit the approval of operations with such transponders after July 1, 1975, if the applicable performance standards of TSO-C74c and the environmental standards of the TSO under which the equipment was manufactured are shown to be met.

One comment stated that the design tolerances specified in subparagraph II A.5.a. of Part 2 in RTCA Document DO-144 are much stricter than would be required in actual usage. The commentator recommended that transponders should not reply to more than 10 percent of the interrogations when the interval between pulses P_1 and P_3 differs from that defined in Appendix A for the mode selected in the transponder by more than ±15 percent of the nominal specification. The FAA does not agree that the tolerances are much stricter than that required in actual usage. Furthermore, the requirement specified in the proposed TSO is consistent with that required by ICAO for international operations.

One comment recommended that subparagraph II A.5.b. of Part 2 in RTCA Document DO-144 not be included in the TSO on the ground that its requirements are duplicated in subparagraph II A.9.b. of that document. To the contrary, however, subparagraph II A.5.b. applies only to the reply capability of the transponder in response to single pulses, while subparagraph II A.9.b. applies to both reply and suppression action to pulses wider than 1.5 microseconds.

The FAA also disagrees with a recommendation that the dead time specified in paragraph II A.6. of Part 2 of RTCA Document DO-144 be increased from 125 microseconds to 500 microseconds, thereby reducing transponder live time. The rapid increase in the use of Mode C ground equipment by civil and military facilities requires a high degree of system reliability to assure that adequate replies are obtained on each interrogation during critical periods. In areas where multiple interrogators operate, high transponder live time is essential for altitude data.

One comment suggested that the test of suppression specified in paragraph II A.7. of Part 2 in RTCA Document DO-144 be performed with the received amplitude P_2 greater than the received amplitude of P_1 by 2 db, or more, and that the suppression re-initiation period be increased from 2 to 50 microseconds. The FAA does not agree. Due to the effects of lobing caused by reflection from the surface of the earth, the signal levels of P_1 and P_2, which are radiated from different ground antennas at slightly different heights above ground, frequently arrive at the aircraft at equal levels. For suppression of side lobe signals, it is essential that transponders provide suppression action at equal signal levels. In addition, to avoid unacceptable interference with the operations of military facilities, the retention of the 2 microsecond suppression reinitiation period is essential.

In response to a comment that subparagraph II A.8.c. of Part 2 in RTCA Document DO-144 could be misinterpreted, a new § 37.180(a)(2)(i), entitled "Exceptions" has been added to the proposed TSO which replaces that subparagraph with a requirement that clearly specifies the range of received signal amplitude over which the reply characteristics apply.

In reply to another comment recommending the elimination of the requirements of paragraph II A.9. of Part 2 in RTCA Document DO-144, an exception has been added as new § 37.180(a)(2)(ii) to relieve the manufacturer from complying with subparagraph II A.9.a. Field testing has shown that transponder squitter due to noise is not a significant problem. The requirement for narrow pulse rejection is not needed if the random triggering and suppression rate requirements of paragraph II A.11. of Part 2 in RTCA Document DO-144 are met. On the other hand, service experience and testing indicate that the wide pulse type interference associated with the requirements of subparagraph II A.9.b. does present a problem so that compliance is required.

A comment recommended elimination of the echo suppression and recovery requirement contained in paragraph II A.10. of Part 2 in RTCA Document DO-144 on the basis that the problem is caused by inadequate ground equipment. The FAA does not agree. Echoes (multipath signals) caused by signal reflections from terrain and buildings, cause practical problems in transponder operation. Extensive experience in the operation of the Air Traffic Control Radar Beacon System (ATCRBS) has developed a standard desensitization and recovery curve to minimize the multipath effects on the operation of transponders. Moreover, the FAA locates its own traffic control radar receiving stations so as to minimize the number of echoes. However, since it is practically impossible to eliminate all echoes through the geographical location of the ground station, the proposed requirement providing for capability of the airborne equipment to reject that type of signal has been retained.

One commentator objected to the requirement contained in paragraph II A.13. of Part 2 in RTCA Document DO-144 on the ground that, in the FAA's planned airborne environment, an interrogation rate of 1,000 per second will seldom be exceeded. It was contended that if the purpose of the requirement is to protect the airborne transmitter from damage due to excessive replies, more straightforward means are available than are contained in paragraph II A.13. The FAA does not agree. The Air Traffic Control Radar Beacon System operates on a common frequency with the military IFF system, and in many areas of the country, the operation of civil and military facilities results in peak interrogation rates exceeding 1,000 per second. Reply rates must be limited in order to provide adequate service to the closer (stronger) interrogators since excessively high rates would result in unacceptable interference to all users.

One commentator, referring to subparagraph II A.16.b.(1) of Part 2 in RTCA Document DO-144, asked whether there was any requirement that the transponder's mode switch have any function other than Off, Standby, On, and Altitude Off (i.e., stop transmitting altitude information pulses while still transmitting the Mode C framing pulses and normal Mode A replies). Subparagraph II A.16.b.(1) requires the transponder to respond to Mode C interrogations independently of other modes or codes manually selected. It does not require other modes or codes to be available or selectable.

The FAA does not agree with a comment objecting to the receiver bandwidth limitation contained in paragraph II A.18. of Part 2 in RTCA Document DO-144. The commentator contended that those requirements are for the purpose of limiting squitter and suppressions, which is adequately covered by paragraph II A.11. of RTCA Document DO-144. While that assertion may be true for interference originating within the aircraft, paragraph II A.11. does not provide protection from external sources of interference. The only practical means of protecting transponders from interference originating external to the aircraft is by a reasonable limitation on the receiver bandwidth.

One commentator stated that if the TSO is being amended to permit the operation of the Genave PWI system, proposed paragraph 2.7.c.(2) of the "Federal Aviation Standard, Airborne ATC Transponder Equipment" should be changed because the present wording rules out that system. The FAA does not agree. The proposed change was not limited to the Genave PWI system and was worded broadly enough to include all types of external attachments. The maximum allowable dead time of 4.5 percent should not be reached by the Genave PWI since it does not generate suppression pulses during the alarm mode. ATCRBS side lobe interrogations are considered valid interrogation signals and are not included as part of the 4.5 percent.

A comment also questioned whether paragraph 2.7.c.(2) of the "Federal Aviation Standard, Airborne ATC Transponder Equipment" applies to internal suppression or if that paragraph requires the use of an external suppression jack on a Class 2A transponder. The dead time created by means other than normal interrogations, as stated in paragraph 2.7.c.(2), refers only to external devices such as TACAN, DME, or PWI. The paragraph does not require a manufacturer to provide an external suppression jack. In reply to another question, the proposal does not create any additional environmental categories.

One commentator opposed the 2,500 microsecond and 4.5-percent duty cycle dead time requirements of proposed paragraph 2.7.c.(2) of the Federal Aviation Standard because the increase in dead time would permit a loss of transponder replies and would impair the accuracy of symbology used in new automated air traffic control systems. The commentator recommended limiting dead time from external sources to no more than 85 microseconds per suppression period at a random repetition rate such that dead time occupies no more than 2.6 percent of the time. The FAA does not agree. A maximum of 2,500 microseconds dead time per suppression limited to a 4.5-percent duty cycle will not inhibit more than one reply per beamwidth at a terminal radar (ARTS) installation. The terminal ATCRBS facilities operate at a nominal 18 hits per beamwidth, and an occasional missing reply out of the 18 replies is not believed serious enough to hinder the accuracy of symbology used in new automated ATC systems.

Another comment contended that the requirement of paragraph 2.7.(c) of the Federal Aviation Standard and paragraph II A. of Part 2 in RTCA Document DO-144 could be construed to require duty cycle limitations on inputs capable of generating transponder dead time and that an unnecessary burden could result. While the commentator has correctly stated the requirement, the FAA does not agree that the requirement creates an unnecessary burden. The dead time requirement need only be met taking into consideration the foreseeable inputs to the transponder.

One comment, while supporting the use of the TSO system for the approval of transponders, objected to the incorporation of RTCA Document DO-144 into the TSO. The commentator asserted that DO-144 was intended to fulfill a need for approval of the installed system and that its incorporation would result in a TSO that applies an "approval-per-installation philosophy" placing a burden on the manufacturer which would result in a more costly transponder. Apparently the commentator construed the proposed TSO requirement as referring to both section II and section III of Part 2 in RTCA Document DO-144. The minimum performance standards specified in the TSO requirement are contained only in section II. Section III merely describes one acceptable method (but not the only method) of determining compliance with those minimum performance standards. Other methods (not necessarily involving installation of the transponder in an aircraft) may be used.

In connection with section III of Part 2 in RTCA Document DO-144, one comment stated that the test condition specified in subparagraph III B.l.d.(4) is unnecessarily severe. The FAA agrees. However, as noted above, section III merely describes one acceptable method of determining compliance with the minimum performance standards. If a manufacturer does not choose to use the test condition in subparagraph III B.l.d.(4), he may use any other acceptable test condition, such as repeating the test condition of subparagraph III B.l.d.(2) but with P_2 at the nominal interval following P_1, and combining the interrogation signal set to an interrogation rate of 100 interrogations per second with a non-synchronous single pulse generator operating at 1,000 prf and at an r_f level 10db below that of P_1 and P_3.

Another comment question the note following section III B.l.j.(2) of Part 2 in RTCA Document DO-144. An acceptable alternative to that note would be to exclude the intervals between pulses corresponding to a normal Mode 3/A, Mode C, and a side-lobe interrogation.

In addition, with reference to RTCA Document DO-144, it should be noted that subparagraphs IIA.16.b. (2), (3), (4), (5), and (6) of Part 2 of that document contain standards for ATC transponder equipment systems that incorporate complete altitude reporting capability, including: (1) An analog-to-digital converter, (2) a pressure-altitude data source, (3) a capability of reporting pressure altitude, and (4) a correspondence of the reported altitude with the altitude indicated by the aircraft flight altimeter. It was not the intent of the FAA in this rule making action to require ATC transponders to have complete altitude reporting capability. Therefore, the proposal has been revised by adding new § 37.180(a)(2) (iii) and (iv) which delete the requirement for compliance with those standards unless the manufacturer elects to provide complete altitude reporting capability. However, the requirement that all transponders reply to Mode C interrogations with framing pulses F_1 and F_2 is retained in order to facilitate the incorporation of complete altitude reporting capability by the transponder users if that capability is required or if the user should desire that feature. The areas of operation in which complete altitude reporting capability will be required, is the subject of the rule making action proposed in Notice 72-12 (37 F.R. 7527).

Following further review of proposed §§ 91.24, 121.345, 127.123, and 135.143, the proposals have been revised to more clearly indicate that ATC transponders may be approved under the TSO system or in conjunction with type certification procedures, or in any manner approved by the Administrator, but in any event they must meet the performance and environment requirements of the applicable TSO standards.

Finally, transponder field tests conducted subsequent to the issuance of Notice 71-10 indicate that a large number of the transponder deficiencies occurring in service could be prevented if the transponder were inspected and adequately maintained. Accordingly, a new § 91.177 is being adopted which requires that after January 1, 1974, ATC transponder equipment installed and used as provided in this amendment must be tested and inspected and found to comply with the maintenance requirements which are being adopted as new Appendix F to Part 43. New § 91.177 applies only to ATC transponders that, under the provisions of § 91.24, § 121.345(c), § 127.123(b), or § 135.143(c), are required to meet the standards specified therein. While this requirement was not proposed in Notice 71-10, the FAA has determined that safety requires that the ATC transponders be inspected annually to assure that they continue to meet the TSO standards. Further delays in implementing this course of action would

not be in the public interest. Therefore, this final rule includes inspection and testing requirements for transponders. However, since a compliance date has been established subsequent to the effective date of the amendment, interested persons may submit comments on the new § 91.177 of Part 91 and the new Appendix F to Part 43. The FAA will consider all comments received on or before March 27, 1973, and may further amend the regulations in the light of these comments.

In consideration of the foregoing, Parts 37, 43, 91, 121, 127, and 135 of the Federal Aviation Regulations are amended as follows, effective January 26, 1973.

PART 37—TECHNICAL STANDARD ORDER AUTHORIZATIONS

A. Part 37 is amended by amending § 37.180 as follows:

1. Paragraphs (a), (b), (c), and (d) are amended and a new paragraph (e) is added, to read as follows:

§ 37.180 Airborne ATC transponder equipment—TSO–C74c.

(a) *Applicability.* This technical standard order prescribes the minimum performance standards which airborne ATC transponder equipment must meet in order to be identified with the applicable TSO marking. New models of such equipment that are to be so identified and that are manufactured on or after January 26, 1973, must meet the following performance and environmental standards:

(1) *Performance standards.* (i) Equipment marked as Class 1A must be equipment intended for installation in aircraft that operate at altitudes above 15,000 feet and must meet the minimum performance standards of "Federal Aviation Administration Standard, Airborne ATC Transponder Equipment," set forth at the end of this section, as applicable.

(ii) Equipment marked as Class 1B must be equipment intended for installation in aircraft that operate at altitudes not exceeding 15,000 feet and must meet the minimum performance standards of "Federal Aviation Administration Standard, Airborne ATC Transponder Equipment," set forth at the end of this section, as applicable.

(iii) Equipment marked as Class 2A must be equipment intended for installation in aircraft that operate at altitudes above 15,000 feet and must meet the minimum performance standards set forth in Section II of Part 2 in Radio Technical Commission for Aeronautics Document No. DO–144 entitled "Minimum Operational Characteristics—Airborne ATC Transponder Systems," dated March 12, 1970, and Change No. 1 to DO–144, Paper 232–70/EC–643, dated November 5, 1970, as applicable, except as provided in subparagraph (2) of this paragraph.

(iv) Equipment marked as Class 2B must be equipment intended for installation in aircraft that operate at altitudes not exceeding 15,000 feet and must meet the minimum performance standards set forth in Section II of Part 2 in Radio Technical Commission for Aeronautics Document No. DO–144 entitled, "Minimum Operational Characteristics—Airborne ATC Transponder Systems," dated March 12, 1970, and Change No. 1 to DO–144, Paper 232–70/EC–643, dated November 5, 1970, as applicable, except as provided in subparagraph (2) of this paragraph.

(2) *Exceptions.* (i) In lieu of the requirements in subparagraph II A.8.c. of Part 2 in RTCA Document DO–144, the reply characteristics apply over a received signal amplitude range between minimum triggering level and a level of −21 dbm.

(ii) The requirement specified in subparagraph II A.9.a. of Part 2 in RTCA Document DO–144 need not be complied with.

(iii) The requirements of subparagraph II A.16.b. (2) and (3) of Part 2 of RTCA Document DO–144, in so far as, they pertain to pressure altitude information pulses, must be complied with only if complete altitude reporting capability is provided.

(iv) The requirements of subparagraph II A.16.b. (4), (5), and (6) of Part 2 of RTCA Document DO–144 must be complied with only if complete altitude reporting capability is provided.

(3) *Environmental standards.* RTCA Document No. DO–138 entitled "Environmental Conditions and Test Procedures for Airborne Electronic/Electrical Equipment and Instruments," dated June 27, 1968, must be used in determining the environmental conditions over which the equipment has been designed to operate. Classes 2A and 2B equipment need only be tested for the environmental conditions of temperature and altitude, humidity, shock, vibration, and power input voltage set forth in paragraphs 4.0, 5.0, 6.0, 7.0, and 9.0 of DO–138.

(b) *Availability of documents.* RTCA Document Nos. DO–138, dated June 27, 1968, and DO–144, dated March 12, 1970, as amended by Change No. 1 (Paper 232–70/EC–643), dated November 5, 1970, are incorporated herein in accordance with 5 U.S.C. 552(a)(1) and § 37.23 of the Federal Aviation Regulations and are available as indicated in § 37.23. Additionally, RTCA Documents Nos. DO–138 and DO–144, as amended, may be examined at any FAA regional office of the Chief of Engineering and Manufacturing Branch (or in the case of the Western Region, the Chief, Aircraft Engineering Division) and may be obtained from the RTCA Secretariat, Suite 655, 1717 H Street NW., Washington, DC 20006, at a cost of $8 per copy for Document No. DO–138 and $6 per copy for Document No. DO–144.

(c) *Marking.* In addition to the markings specified in § 37.7, the equipment must meet the following requirements:

(1) The environmental categories over which it has been designed to operate as set forth in Appendix B of RTCA Document No. DO–138 must be permanently and legibly marked on the equipment. Where an environmental test procedure is not applicable and the test is not conducted, an "X" should be placed in the space assigned for that category.

(2) The class which the equipment meets must be permanently and legibly marked on the equipment. Equipment which meets the requirements of more than one class need only be marked with the class which contains the more severe requirements. When listed in order of severity of requirements, highest first, the classes are: 1A, 1B, 2A, and 2B.

(3) Each separate component of equipment (antenna, receiver-transmitter, etc.) must be permanently and legibly marked with at least the name of the manufacturer, the TSO number, and the environmental categories over which it is designed to operate.

(d) *Data requirements.* (1) In accordance with § 37.5, the manufacturer must furnish to the Chief, Engineering and Manufacturing Branch, Flight Standards Division (or in the case of the Western Region, the Chief, Aircraft Engineering Division), Federal Aviation Administration, in the region in which the manufacturer is located, one copy of the following technical data:

(i) Manufacturer's operating instructions and equipment limitations.

(ii) Installation procedures with applicable schematic diagrams, wiring diagrams, and specifications. Indicate any limitations, restrictions, or other conditions pertinent to the installation.

(iii) Manufacturer's test report(s).

(iv) Equipment data sheets specifying, within the prescribed range of environmental conditions, the actual performance of equipment of that type with respect to each performance factor prescribed in the applicable standard. Performance data for abnormal environmental conditions may also be included.

(2) One copy of the technical data specified in subdivisions (i), (ii), and (iv) of subparagraph (1) of this paragraph must be furnished with each article.

(e) *Previously approved equipment.* Airborne ATC Transponder Equipment approved prior to the effective date of this section may continue to be manufactured under the provisions of its original approval.

2. Paragraph 2.7c. of the "Federal Aviation Standard, Airborne ATC Transponder Equipment," is amended to read as follows:

2.7 *Transponder discrimination and desensitization.*

* * * * *

c. *Dead time.* (1) After reception of a proper interrogation, the transponder must reply to no other interrogation for the duration of the reply pulse train. This dead time must end no later than 125 microseconds after the transmission of the last reply pulse of the group.

(2) The dead time of the transponder created by means other than normal interrogations shall not exceed a period of more than 2,500 miscroseconds duration at a maximum duty cycle of 4.5 percent.

3. Paragraphs 2.8 and 2.11 of the "Federal Aviation Standard, Airborne

ATC Transponder Equipment" are amended by deleting the parenthetical references to "(Class I)" and to "(Class II)."

PART 43—MAINTENANCE, PREVENTIVE MAINTENANCE, REBUILDING, AND ALTERATION

B. Part 43 is amended by adding a new Appendix F 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:

(a) Reply radio frequency:

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

(b) Reply transmission characteristics, framing pulses:

(1) Verify that the time interval between the 0.5 amplitude points on the leading edges of the two framing pulses is 20.3±0.10 microseconds.

(c) Reply codes:

(1) *Identification.* Verify that all Mode 3/A reply pulses listed in Table 1 are present.

TABLE 1

Pulse	Position (microseconds)	Pulse	Position (microseconds)
F_1	0.00	D_1	13.05
C_1	1.45	B_2	14.50
A_1	2.90	D_2	15.95
C_2	4.35	B_4	17.40
A_2	5.80	D_4	18.85
C_4	7.25	F_2	20.30
A_4	8.70	SPI	24.75
B_1	11.60		

(2) *Pressure altitude transmissions.*—(i) Verify that the transponder response to mode C interrogations consists only of framing pulses F_1 and F_2. If complete altitude reporting capability is provided, the altitude digitizer may not be connected to the transponder at the time of the test.

(ii) Verify that the transponder response to mode C interrogations consists of only framing pulses F_1 and F_2 with the altitude switch in the "off" position.

(iii) If complete altitude reporting capability is provided, verify that the transponder response to mode C interrogations consists of information pulses denoting pressure altitude at the time of the test.

(d) Reply pulse width:

Verify that the duration of the F_1 and F_2 pulses between the 0.5 amplitude points on the leading and trailing edge is 0.45 ± 0.10 microseconds with—

(1) The transponder replying on mode 3/A, code 0000, and

(2) The transponder replying on mode 3/A, code 7777.

(e) Suppression:

(1) Verify that the transponder response to mode 3/A interrogations does not exceed five replies per second when the amplitude of the P_2 pulse is equal to the P_2 pulse.

(2) Verify that the transponder response to mode 3/A interrogations is at least 450 replies per second when the amplitude of the P_2 pulse is 9 db less than the P_2 pulse.

(f) Receiver sensitivity:

(1) Verify that the receiver sensitivity of the system as installed including tranmission line loss is −73 ±4 dbm.

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

(g) Transmitter power output:

(1) Verify that class 1A and 2A transponders have a peak pulse power at the antenna end of the transmission line of at least +21 dbw and not more than +27 dbw.

(2) Verify that class 1B and 2B transponders have a peak pulse power at the antenna end of the transmission line of at least +18.5 dbw and not more than +27 dbw.

(h) Records:

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

PART 91—GENERAL OPERATING AND FLIGHT RULES

C. Part 91 is amended as follows:

1. By adding a new § 91.24, following § 91.23, to read as follows:

§ 91.24 ATC transponder equipment.

(a) ATC transponder equipment installed after January 1, 1974, in U.S. registered civil aircraft not previously equipped with an ATC transponder and all ATC transponder equipment used in U.S. registered civil aircraft after July 1, 1975, must meet the performance and environmental requirements of any class of TSO–C74b or any class of TSO–C74c, as appropriate, except that the Administrator may approve the use of TSO–C74 or TSO–C74a equipment beyond July 1, 1975, if the applicant submits data showing that such equipment meets the minimum performance standards of the appropriate class of TSO–C74c and the environmental conditions of the TSO under which it was manufactured.

(b) This section does not apply to operations conducted under Parts 121, 123, 127, or 135 of this chapter.

2. By adding a new § 91.177, following § 91.175, to read as follows:

§ 91.177 ATC transponder tests and inspections.

(a) After January 1, 1974, no person may use an ATC transponder that is specified in § 91.24, § 121.345(c), § 127.123(b), or § 135.143(c) of this chapter, unless, within the preceding 12 calendar months, that ATC transponder has been tested and inspected and found to comply with Appendix F of Part 43 of this chapter.

(b) The tests and inspections specified in paragraph (a) of this section may be conducted by—

(1) A certificated repair station properly equipped to perform those functions and holding—

(i) A radio rating, class III;

(ii) A limited radio rating appropriate to the make and model transponder to be tested;

(iii) A limited rating appropriate to the test to be performed; or

(iv) A limited rating for a manufacturer issued for the transponder in accordance with § 145.101(b)(4) of this chapter; or

(2) A certificate holder authorized to perform maintenance in accordance with § 121.379 or § 127.140 of this chapter; or

(3) The manufacturer of the aircraft on which the transponder to be tested is installed, if the transponder was installed by that manufacturer.

PART 121—CERTIFICATION AND OPERATIONS: DOMESTIC FLAG AND SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT

D. Part 121 is amended by adding a new paragraph (c) to § 121.345 to read as follows:

§ 121.345 Radio equipment.

* * * * *

(c) ATC transponder equipment installed after January 1, 1974, in aircraft not previously equipped with an ATC transponder and all ATC transponder equipment used after July 1, 1975, must meet the performance and environmental requirements of any class of TSO–C74b, or class 1A or class 1B of TSO–C74c, as appropriate, except that the Administrator may approve the use of TSO–C74 or TSO–C74a equipment beyond July 1, 1975, if the applicant submits data showing that such equipment meets the minimum performance standards of class 1A or class 1B of TSO–C74c and the environmental conditions of the TSO under which it was manufactured.

PART 127—CERTIFICATION AND OPERATIONS OF SCHEDULED AIR CARRIERS WITH HELICOPTERS

E. Part 127 is amended by designating the substance of present § 127.123 as paragraph (a) and adding a new paragraph (b) to § 127.123 to read as follows:

§ 127.123 Radio equipment.

* * * * *

(b) ATC transponder equipment installed after January 1, 1974, in helicopters not previously equipped with an ATC transponder and all ATC transponder equipment used after July 1, 1975, must meet the performance and environmental requirements of any class of TSO–C74b, or class 1A or class 1B of TSO–C74c, as appropriate, except that the Administrator may approve the use of TSO–C74 or TSO–C74a equipment beyond July 1, 1975, if the applicant submits data showing that such equipment meets the minimum performance standards of class 1A or class 1B of TSO–C74c and the environmental conditions of the TSO under which it was manufactured.

PART 135—AIR TAXI OPERATORS AND COMMERCIAL OPERATORS OF SMALL AIRCRAFT

F. Part 135 is amended by amending § 135.143 by adding a new paragraph (c) to read as follows:

§ 135.143 General requirements.

* * * * *

(c) ATC transponder equipment installed after January 1, 1974, in aircraft not previously equipped with an ATC transponder and all ATC transponder equipment used after July 1, 1975, must meet the performance and environmental requirements of any class of TSO–

C74b, or class 1A or class 1B of TSO-C74c, as appropriate, except that the Administrator may approve the use of TSO-C74 or TSO-C74a equipment beyond July 1, 1975, if the applicant submits data showing that such equipment meets the minimum performance standards of class 1A or class 1B of TSO-C74c, and the environmental conditions of the TSO under which it was manufactured.

(Secs. 313(a), 601, 603, 604, 605, Federal Aviation Act of 1958, 49 U.S.C. 1354(a), 1421, 1423, 1424, 1425, sec. 6(c), Department of Transportation Act, 49 U.S.C. 1655(c))

Issued in Washington, D.C., on December 18, 1972.

J. H. SHAFFER,
Administrator.

NOTE: The incorporation by reference in this document was approved by the Director of the FEDERAL REGISTER on April 16, 1969.

Title 14—Aeronautics and Space

CHAPTER I—FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

[Docket No. 10955, Amdt. 37-35, 43-17, 91-107, 121-101, 127-31, 135-33] 34

SUBCHAPTER C—AIRCRAFT

PART 37—TECHNICAL STANDARD ORDER AUTHORIZATIONS

PART 43—MAINTENANCE, PREVENTIVE MAINTENANCE, REBUILDING, AND ALTERATION

Airborne ATC Transponder Equipment

Correction

In FR Doc. 72-22184 appearing at page 28495 in the issue for Wednesday, December 27, 1972 the following changes should be made:

1. In § 37.180, in paragraph (a)(1)(iii), (2)(i), (ii), (iii), and (iv), in all references to Part 2 of RTCA Document DO-144 the figure "2" should read "two".

2. In Appendix F to Part 43 the last line of (e)(1), reading "of the P_2 pulse is equal to the P_2 Pulse.", should read, "of the P_2 pulse is equal to the P_1 Pulse."; and the last line of (e)(2), now reading "P_2 pulse is 9 db less than the P_2 pulse.", should read "P_2 pulse is 9 db less than the P_1 pulse."