



# Technical Standard Order

PROPOSED

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**Subject: TSO-C38e, VHF RADIO COMMUNICATIONS RECEIVING EQUIPMENT OPERATING WITHIN THE RADIO FREQUENCY RANGE 117.975 TO 137.000 MEGAHERTZ**

**1. PURPOSE.** This Technical Standard Order (TSO) tells persons seeking a TSO authorization or letter of design approval what minimum performance standards their Very High Frequency (VHF) communications receiving equipment must first meet in order to obtain approval and be identified with the applicable TSO marking. Title 14 of the Code of Federal Regulations (14 CFR) Part 21, Subpart O, prescribes the requirements and rules governing TSO Authorizations. This TSO updates the requirements of TSO-C38d to include 8.33 kHz channel spacing capability.

**2. APPLICABILITY.**

**a.** This TSO is effective for new applications submitted after the effective date of this TSO. All prior revisions to this TSO are no longer effective and, in general, applications will not be accepted after the effective date of this TSO. However, applications submitted against the previous version of this TSO may be accepted up to six months after the effective date of this TSO, in cases where we know that the applicant was working against the earlier minimum performance standards before the new change became effective.

**b.** VHF communications receiving equipment approved under a previous TSO authorization may continue to be manufactured under the provisions of their original approval, as specified in 14 CFR § 21.603(b). However, major design changes to VHF communications receiving equipment approved under previous versions of this TSO requires a new authorization under this TSO, per 14 CFR § 21.611(b).

**3. REQUIREMENTS.** New models of VHF communications receiving equipment that are to be so identified and that are manufactured on or after the effective date of this TSO must meet the MPS set forth in Section 2 of RTCA document (RTCA/DO)-186A, "Minimum Operational Performance Standards For Airborne Radio Communications Equipment Operating Within The Radio Frequency Range 117.975 - 137.000 MHz", dated October 20, 1995, including Change 1 dated September 29, 1998 and Change 2 dated March 5, 2002.

The minimum performance standards referenced herein allow for different equipment classes as defined by RTCA/DO-186A, Section 2.1.8. There are four equipment classes and they are summarized in Table 1.

Table 1: Equipment Class for VHF Comm Receiving Equipment

Equipment Class	Description
C	Receiver used in a 25 kHz channel separation environment having offset carrier operation
D	Receiver used in a 25 kHz channel separation environment not having offset carrier operation
E	Receiver used in an 8.33 kHz channel separation environment not having offset carrier operation

**a. Functionality.** The standards of this TSO apply to equipment intended for aircraft VHF amplitude modulated (AM) communications operating in the radio frequency range of 117.975 MHz to 137.000 MHz. This includes 25 and 8.33 kHz channel spacing capabilities. The VHF communication equipment covered by this TSO is primarily intended for Aeronautical Operational Control (AOC) and Air Traffic Services (ATS) safety communications. The equipment developed pursuant to this TSO is envisioned to play an integral role with the aircraft equipment used to communicate tactical and strategic information directly related to the safety of flight.

**b. Failure Condition Classification.** Failure of the function defined in paragraphs 3 and 3a of this TSO has been determined to be a major failure condition, and the applicant must develop the system to at least the design assurance level commensurate with this failure condition classification.

**c. Functional Qualification.** The required performance shall be demonstrated under the test conditions specified in Section 2.4 of RTCA/DO-186A, or most current revision.

**d. Environmental Qualification.** The applicable environmental test procedures are specified in RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment," dated July 29, 1997, including Change 1 dated Dec 14, 2000, Change 2 dated June 12, 2001 and Change 3 dated December 5, 2002. Whereas, the applicable environmental performance requirements used during the environmental test procedures are specified in Section 2.3 of RTCA/DO-186A, or most current revision.

**e. Software Qualification.** If the article includes software, the software must be developed in accordance with RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," dated December 1, 1992.

**f. Deviations.** The FAA has provisions for using alternative or equivalent means of compliance to the criteria set forth in the minimum performance standards of this TSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per 14 CFR § 21.609.

**4. MARKING.** In accordance with 14 CFR § 21.607(d), articles manufactured under this TSO must be marked as follows:

**a.** At least one major component must be permanently and legibly marked with all of the information listed in 14 CFR § 21.607(d), except for the following: the option in 14 CFR § 21.607(d)(2), where the name, type and part number must be used in lieu of the optional model number; and the option in 14 CFR § 21.607(d)(3), where the date of manufacture must be used in lieu of the optional serial number.

**b.** In addition to the requirements of 14 CFR § 21.607(d), each separate component that is easily removable (without hand tools), each interchangeable element, and each separate sub-assembly of the article that the manufacturer determines may be interchangeable must be permanently and legibly marked with at least the name of the manufacturer, manufacturer's subassembly part number, and the TSO number.

**c.** If the component includes a digital computer, the part number must include hardware and software identification, or a separate part number may be utilized for hardware and software. Either approach must include a means for showing the modification status. Note that similar software versions, which have been approved to different software levels, must be differentiated by part number.

**d.** When applicable, identify the equipment as an incomplete system or that the appliance accomplishes additional functions beyond that described in paragraphs **3** and **3a** of this TSO. Description of additional functions in the installation procedures and limitations of **5.a.(2)** of this TSO would qualify as an alternative to marking the component; however, the component must be marked with the drawing that provides the installation procedures and limitations.

**e.** If any deviations have been granted, place the additional permanent marking, “(Dev)”, after the TSO number. Any deviations that have been granted must be described in the installation procedures and limitations of **5.a.(2)** of this TSO; however, the component must be marked with the drawing that provides the installation procedures and limitations.

**f.** Equipment Class(es) must be marked, as defined in section 2.1.8 of RTCA/DO-186A, or most current revision. An example marking which satisfies this requirement is as follows, “Equipment Class: D and E”. Equipment Class markings in the installation procedures and limitations of **5.a.(2)** of this TSO would qualify as an alternative to marking the component; however, the component must be marked with the drawing that provides the installation procedures and limitations.

#### **5. DATA REQUIREMENTS.**

**a. Application Data.** In accordance with 14 CFR 21.605(a)(2), the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), responsible for the manufacturer's facilities, one copy each of the following technical data to support the FAA design and production approval:

(1) Operating instructions and equipment limitations. The limitations shall be sufficient to describe the operational capability of the equipment. In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

(2) Installation procedures and limitations. The limitations shall be sufficient to ensure that the article, when installed in accordance with the installation procedures, continues to meet the requirements of this TSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations also shall include a note with the following statement:

"The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. The article may be installed only if further evaluation by the applicant, i.e. user/installer, documents an acceptable installation and is approved by the Administrator."

(ii) When applicable, identify the equipment as an incomplete system or that the appliance accomplishes additional functions beyond that described in paragraphs **3** and **3a** of this TSO and describe the functions that are intended to be provided by the appliance.

(iii). Identify the Equipment Class(es) the equipment has been qualified to perform and the functions that are intended to be provided by these class(es). The description should be written such that an installer of the equipment would know the equipment being installed meets the intentions of the installation.

(3) Schematic drawings as applicable to the installation procedures.

(4) Wiring diagrams as applicable to the installation procedures.

(5) Equipment specifications.

(6) List of the components, by part number, that make up the system complying with the standards prescribed in this TSO. Manufacturers should include vendor part number cross-references when applicable.

(7) Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair, for the continued airworthiness of installed equipment, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph **5a(1)** of this TSO, may also be described in the CMM.

(8) Material and process specifications list.

(9) The quality control system description required by 14 CFR §§ 21.605(a)(3) and 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this TSO.

- (10) Manufacturer's TSO qualification test report.
- (11) Nameplate drawing providing the information required by paragraph 4 of this TSO.
- (12) A list of all drawings and processes, including revision level, necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.
- (13) An environmental qualifications form as described in RTCA/DO-160D, or most current version for each component of the system.
- (14) If the article includes a digital computer: Plan for Software Aspects of Certification (PSAC); Software Configuration Index; and Software Accomplishment Summary. The FAA recommends that the PSAC be submitted early in the software development process. Early submittal will allow timely resolution of issues such as partitioning and determination of software levels.

**b. Manufacturer Data.** In addition to the data to be furnished directly to the FAA, each manufacturer must have available for review by the manager of the ACO responsible for the manufacturer's facilities the following technical data:

- (1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this TSO.
- (2) Equipment calibration procedures.
- (3) Corrective maintenance procedures within 12 months after TSO authorization.
- (4) Schematic drawings.
- (5) Wiring diagrams.
- (6) The results of the environmental qualification tests conducted in accordance with RTCA/DO-160D, or most current version.
- (7) If the article includes a digital computer, the appropriate documentation as defined in RTCA/DO-178B, or most current version, including all data supporting the applicable objectives found in Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level.

**c. Furnished Data.**

- (1) One copy of the technical data and information specified in paragraphs 5.a.(1) through (7) of this TSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the equipment, must accompany each article or multiple articles, if furnished to one source, i.e. operator, repair station, etc., manufactured under this TSO.
- (2) If the appliance accomplishes any additional functions beyond that described in paragraphs 3 and 3a of this TSO, then a copy of the data and information specified in paragraphs 5a(12) through (14) must also go to each person receiving for use one or more articles manufactured under this TSO.

**6. AVAILABILITY OF REFERENCED DOCUMENTS.**

**a.** Copies of RTCA Document Nos. DO-160D (including Changes 1, 2 and 3), DO-178B and DO-186A (including Changes 1 and 2) may be purchased from the RTCA Inc., 1828 L Street NW, Suite 805, Washington, D.C. 20036-4001. Copies also can be obtained from RTCA internet website at: [www.rtca.org](http://www.rtca.org).

**b.** Copies of Federal Aviation Regulations 14 CFR Part 21, Subpart O, may be purchased from the Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325. Copies also can be obtained from the Government Printing Office (GPO), electronic CFR Internet website at: [www.access.gpo.gov/ecfr/](http://www.access.gpo.gov/ecfr/).

**c.** Advisory Circular (AC) 20-110L, or current revision, "Index of Aviation Technical Standard Orders", and AC 20-115B, or current revision, "RTCA, Inc., Document RTCA/DO-178B" may be obtained from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, telephone (301) 322-4477 or FAX (301) 386-5394.

**d.** You may get a copy of this proposed TSO from the Internet at: <http://av-info.faa.gov/tso/Tsopro/Proposed.htm> .

David W. Hempe  
Manager, Aircraft Engineering Division  
Aircraft Certification Service