



Technical Standard Order

Subject: AIRCRAFT AUDIO SYSTEMS AND EQUIPMENT

1. **PURPOSE.** This technical standard order (TSO) is for audio systems designers, manufacturers, and installers applying for a TSO authorization or letter of design approval. In it, we (the Federal Aviation Administration, or FAA) tell you what minimum performance standards (MPS) your audio system must meet for approval and identification with the applicable TSO marking.
2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date. We will cancel TSO-C50c, *Audio Selector Panels and Amplifiers*, TSO-C57a, *Headsets and Speakers*, and TSO-C58a, *Aircraft Microphones*, after publishing this TSO.
3. **REQUIREMENTS.** New models of audio equipment identified and manufactured on or after the effective date of this TSO must meet the MPS in Section 2 of RTCA, Inc., document RTCA/DO-214, *Audio Systems Characteristics and Minimum Performance Standards for Aircraft Audio Systems and Equipment*, dated March 2, 1993.
 - a. **Functionality.** This TSO's standards apply to equipment intended to support aircraft audio systems' response characteristics. In it, we recommend how users and designers can improve communications equipment. We also recommend minimum standards and test procedures for aircraft microphones (except carbon), headsets, handsets and loudspeakers, and audio systems.
 - b. **Failure Condition Classification.** Failure of the intended function defined in paragraphs 3 and 3a of this TSO is a *major* failure condition. Develop audio systems and equipment to at least the design assurance level for this failure condition.
 - c. **Environmental Qualification.** Test the equipment to the conditions in RTCA/DO-160E, *Environmental Conditions and Test Procedures for Airborne Equipment*, dated December 9, 2004. Find the standards for these test procedures in Appendix A of RTCA/DO-160E.
 - d. **Functional Qualification.** Demonstrate the required performance under the test conditions in RTCA/DO-214, *Equipment Performance Requirements and Test Procedures*, dated March 2, 1993.

e. Software Qualification. If the article includes a digital computer, develop the software following RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992.

f. Complex Electronic Hardware (CEH). If the hardware element contains programmable hardware with safety assurance level of C, D, or E, evaluate the hardware by test and analysis, or by demonstrating compliance with RTCA/DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*, dated April 19, 2000. If the hardware element contains programmable hardware with a safety assurance level of A or B, the electronic hardware must demonstrate compliance with RTCA/DO-254.

g. Deviations. We have provisions for using alternative or equivalent means of compliance to the criteria in this TSO. If you use these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation per Title 14, Code of Federal Regulations (14 CFR) § 21.609.

4. MARKING.

a. Mark at least one major component permanently and legibly with all information in 14 CFR § 21.607(d), except the following:

(1) 14 CFR § 21.607(d)(2). Use the article's name, type, and part number. Do not use the optional model number.

(2) 14 CFR § 21.607(d)(3). Use the date of manufacture instead of the optional serial number, when the information is critical for maintenance or inspections.

b. Also, mark the following permanently and legibly with at least the manufacturer's name, subassembly part number, and the TSO number:

(1) Each component that is easily removable (without hand tools),

(2) Each interchangeable element, and

(3) Each sub-assembly of the article that you determined may be interchangeable.

(4) If the component includes a digital computer, the part number must include hardware and software identification. Or, use separate part numbers for hardware and software. Either approach must include a means of showing the modification status.

NOTE: Similar software versions, approved to different software levels, must be differentiated by part number.

c. When applicable, identify the equipment as an incomplete system or that it performs functions beyond those described in paragraphs **3** and **3a**.

5. APPLICATION DATA REQUIREMENTS. Under 14 CFR § 21.605(a)(2), as a manufacturer, you must give the FAA's aircraft certification office (ACO) manager responsible

for your facilities one copy of the following technical data to support our design and production approval:

a. Operating instructions and equipment limitations, sufficient to describe the equipment's operational ability.

b. Installation procedures and limitations, sufficient to ensure your audio system, when installed following the installation procedures, continue to meet this TSO's requirements. The limitations must identify any unique aspects of the installation, and include a note with the following statement:

The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. The article may be installed only following 14 CFR part 43 or the applicable airworthiness requirements.

c. Schematic drawings of the installation procedures.

d. Wiring diagrams of the installation procedures.

e. List of the components (by part number) that make up the audio system complying with the standards in this TSO. Include vendor part number cross-references, when applicable.

f. Instructions for periodic maintenance, calibration, and repair necessary for continued airworthiness of installed equipment. Instructions should include recommended inspection intervals and service life.

g. Material and process specifications list.

h. The quality control system description required by 14 CFR §§ 21.605(a)(3) and 21.143, including functional test specifications used to test each production article.

i. Manufacturer's TSO qualification test report.

j. Nameplate drawing with the information required by paragraph 4 of this TSO.

k. An environmental qualifications form described in RTCA/DO-160D for each component of the system.

l. A list of all drawings and processes necessary to define the article's design. For a minor change, follow the directions in 14 CFR § 21.611(a).

m. If the article includes a digital computer: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary. We recommend that you submit the PSAC early in the software development process. Early submittal allows us to quickly resolve issues such as partitioning and determining software levels.

n. If the article contains complex electronic hardware: a plan for hardware aspects of certification (PHAC), hardware configuration index, and hardware accomplishment summary. As with software, we recommend early submittal of the PHAC to allow for timely resolution of complex electronic hardware issues related to design assurance levels.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to the FAA, you as a manufacturer must give the manager of the responsible ACO the following technical data:

- a. The functional test specifications for testing each production article to ensure compliance with this TSO.
- b. Equipment calibration procedures.
- c. Corrective maintenance procedures within 12 months after TSO authorization.
- d. Schematic drawings.
- e. Wiring diagrams.
- f. Manufacturer's TSO qualification test report.
- g. The results of the environmental qualification tests conducted following RTCA/DO-160D.
- h. If the article includes a digital computer, the appropriate documentation defined in RTCA/DO-178B. Include all data supporting the applicable objectives in Annex A, *Process Objectives and Outputs by Software Level*, of RTCA/DO-178B.
- i. If the article contains electronic hardware, such as programmable logic devices (PLDs), application-specific integrated circuit (ASICs), or both, the appropriate documentation as defined in RTCA/DO-254 for the hardware's design assurance level.

7. FURNISHED DATA REQUIREMENTS. With each article manufactured under this TSO, provide one copy of the following:

- a. Technical data and information in paragraphs **5a** through **5g** and **5l** of this TSO. Add any other data or information necessary for the proper installation, certification, and use, or for continued airworthiness, or both, of the audio equipment.
- b. Data and information in paragraphs **5l** through **5n** of this TSO, if the equipment performs functions beyond those in paragraphs **3** and **3a**. You must send these data to each person receiving one or more aircraft audio systems and equipment.

8. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Order copies of RTCA documents from RTCA Inc., 1828 L Street NW, Suite 805, Washington DC 20036-4001. Telephone (202) 833-9339, fax (202) 833-9434. You may also order them online from the RTCA Internet website at www.rtca.org.

b. Order copies of 14 CFR part 21, subpart O, from the Superintendent of Documents, Government Printing Office, P.O. Box 37154, Pittsburgh PA 15250-7954. Telephone (202) 512-1800, fax (202) 512-2250. You can also order copies from the Government Printing Office's Internet website at www.access.gpo.gov/ecfr.

c. You can find a current list of technical standard orders on the FAA Internet website Regulatory and Guidance Library at www.airweb.faa.gov/rgl. You will also find the TSO Index of Articles at the same site.

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