



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C159a

Effective
Date: 6/30/10

Technical Standard Order

Subject: Next Generation Satellite Systems (NGSS) Equipment

1. **PURPOSE.** This technical standard order (TSO) is for manufacturers applying for a TSO authorization (TSOA) or letter of design approval (LODA). In it, we (the Federal Aviation Administration or FAA) tell you what minimum performance standards (MPS) your Next Generation Satellite Systems (NGSS) equipment must first meet for approval and identification with the applicable TSO marking.
2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date. NGSS equipment approved under previous versions of this TSOA may still be manufactured under the provisions of their original approval.
3. **REQUIREMENTS.** This TSO is for Iridium Satellite system-specific equipment. It includes the Aircraft Earth Station (AES) transceiver equipment, auxiliary equipment and the associated antenna. NGSS equipment identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in RTCA, Inc. document RTCA/DO-262A, *Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS)*, dated December 16, 2008.
 - a. **Functionality.** This TSO's standards apply to avionics equipment intended to provide long range communication services (LRCS) aeronautical mobile satellite (route) services (AMS(R)S) by means of satellite communications between aircraft earth stations (AES), corresponding satellites, and ground earth stations (GES). The NGSS will support both data and voice communications between aircraft users and ground-based users, such as air navigation service providers (ANSP) and aircraft operators.

(1) The functionality of NGSS supports four categories of communication service. Two are in the safety of flight category: air traffic services (ATS) and aeronautical operational control (AOC). The other two are in the non-safety of flight category: aeronautical administrative communication (AAC) and aeronautical passenger communication (APC).

(2) NGSS equipment is intended for oceanic and remote area operations. We determined the failure condition specified in paragraph 3b based on NGSS equipment operating in oceanic and remote area environments. Use of NGSS equipment in other operating environments (for example, high-density terminal/en route domestic airspace) may impact equipment performance and safety considerations.

b. Failure Condition Classification. Failure of the function defined in paragraph **3a** of this TSO is a *minor* failure condition. Loss of the function as defined in paragraph **3a** of this TSO is a *minor* failure condition. Develop the system to, at least, the design assurance level equal to this failure condition classification.

c. Functional Qualification. Demonstrate the required functional performance under the test conditions specified in the Normative Appendix A, section 2.4, of RTCA/DO-262A, *Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS)*, dated December 16, 2008.

d. Environmental Qualification. Demonstrate the required performance under the test conditions specified in the Normative Appendix A, section 2.3, of RTCA/DO-262A, *Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS)*, dated December 16, 2008, using standard environmental conditions and test procedures appropriate for airborne equipment.

NOTE: Although no specific version of RTCA DO-160 environmental conditions and test procedures are specified, use of RTCA/DO-160D (with Changes 1 and 2 only, incorporated) or earlier versions will require substantiation via the deviation process as discussed in paragraph **3f** of this TSO.

e. Software Qualification. If the article includes software, develop the software according to RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992. The software design assurance level should be consistent with the failure condition classification defined in paragraph **3b** of this TSO. All software included in the article definition must be developed in accordance with RTCA/DO-178B.

f. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under 14 CFR § 21.609.

4. MARKING.

a. Mark at least one major component permanently and legibly with all the information in 14 CFR § 21.607(d). The marking must include the serial number.

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), and
- (2) Each subassembly of the article that you determine may be interchangeable.

c. If the article includes a deviation per paragraph **3f** of this TSO, the marking must include a means to indicate a deviation was granted.

d. If the component includes a digital computer, then the part number must include hardware and software identification. Or, you can use a separate part number for hardware and software. Either way, you must include a means to show the modification status.

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

5. APPLICATION DATA REQUIREMENTS. You must give the FAA aircraft certification office (ACO) manager responsible for your facilities a statement of conformance, as specified in 14 CFR § 21.605(a)(1), and one copy each of the following technical data to support our design and production approval. Under 14 CFR § 21.617(a)(2), LODA applicants submit the same data (excluding paragraph **5h**) through their civil aviation authority.

a. Operating instructions and equipment limitations in an installation manual (IM), sufficient to describe the equipment's operational capability. Describe in detail any deviations. If needed, identify equipment by part number, version, revision, and criticality level of software/hardware, classification for use, and environmental categories.

b. Installation procedures and limitations in an IM, sufficient to ensure that the NGSS equipment, when installed according to the installation procedures, still meets this TSO's requirements. Limitations must identify any unique aspects of the installation. The limitations must include a note with the following statement:

This article meets the minimum performance and quality control standards required by a technical standard order (TSO). If you are installing this article on or in a specific type or class of aircraft, you must obtain separate approval for installation.

c. Schematic drawings of the installation procedures.

d. Wiring diagrams of the installation procedures.

e. List of components, by part number, that makes up the NGSS article. Include vendor part number cross-references, when applicable.

f. A component maintenance manual (CMM) or IM, as appropriate, covering periodic maintenance, calibration, and repair, for the continued airworthiness of NGSS. Include recommended inspection intervals and service life, as appropriate.

g. Material and process specifications list.

h. The quality control system (QCS) description required by 14 CFR §§ 21.143 and 21.605(a)(3), including functional test specifications. The QCS should ensure that you will detect any change to the approved design that could adversely affect compliance with the TSO MPS, and reject the article accordingly. (Not required for LODA applicants.)

i. Manufacturer's TSO qualification report showing results of testing accomplished according to paragraph **3c** of this TSO.

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

k. List of all drawings and processes (including revision level) that define the article's design.

l. A summary of the test conditions used for environmental qualifications for each component of the article. For example, a form as described in RTCA/DO-160E, Environmental Conditions and Test Procedures for Airborne Equipment, Appendix A.

m. If the article includes software: 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. Identify functionality, features or performance contained in the article that is not evaluated under paragraph **3** of this TSO (i.e., non-TSO functions). These functions are not approved under 14 CFR Part 21 Subpart O authorization, but can be approved in conjunction with the TSO authorization under the authority of 14 CFR § 21.305(d). You must include the following information with your TSO application:

(1) Description of the non-TSO function(s), such as performance specifications and software, hardware, and environmental qualification levels. Add a statement confirming that the non-TSO functions don't interfere with the article's compliance with the requirements of paragraph **3**.

(2) Installation and operating instructions/limitations for the non-TSO function(s). The IM must contain the following statement: "The non-TSO functions defined in this section are not part of the TSO approval. The non-TSO function data included in this section is approved under 14 CFR § 21.305(d)."

(3) Instructions for continued performance applicable to the non-TSO function(s) defined in paragraph **5n(1)**.

(4) Interface requirements and applicable installation test procedures to ensure compliance with the performance data defined in paragraph **5n(1)**.

(5) Results of test/analysis, as appropriate, to verify that performance of the hosting TSO's performance is not affected by the non-TSO function(s).

(6) Results of test/analysis, as appropriate, to verify intended function of the declared non-TSO function(s) as described in paragraph **5n(1)**.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to us, have the following technical data available for review by the responsible ACO or civil aviation authority:

- a. Functional qualification specifications for qualifying each production article to ensure compliance with this TSO.
- b. Equipment calibration procedures.
- c. Corrective maintenance procedures (within 12 months after TSOA or LODA).
- d. Schematic drawings.
- e. Wiring diagrams.
- f. Material and process specifications.
- g. The results of the environmental qualification tests conducted according to paragraph **3d** of this TSO.
- h. If the article includes software, the appropriate documentation defined in RTCA/DO-178B, including all data supporting the applicable objectives in RTCA/DO-178B, Annex A, Process Objectives and Outputs by Software Level.
- i. If the article contains non-TSO function(s), you must also make available items **6a** through **6h** as they pertain to the non-TSO function(s).

7. FURNISHED DATA REQUIREMENTS.

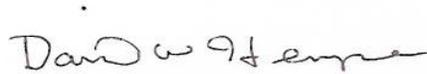
- a. If furnishing one or more articles manufactured under this TSO to one entity (such as an operator or repair station), provide one copy of the data in paragraphs **5a** through **5f** and **5l** of this TSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the NGSS equipment.
- b. If the article contains non-TSO function(s), also include one copy of the data in paragraphs **5n(1)** through **5n(4)**.

8. HOW TO GET REFERENCED DOCUMENTS.

- a. Order RTCA documents from RTCA Inc., 1828 L Street NW, Suite 805, Washington, D.C. 20036. Telephone (202) 833-9339, fax (202) 833-9434. You can also order copies online 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 979050, St. Louis, MO 63197. Telephone (202) 512-1800

Fax (202) 512-2250. You can also order copies online at www.access.gpo.gov. Select "Access," then "Online Bookstore." Select "Aviation," then "Code of Federal Regulations."

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



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