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China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Independent BDS Airborne Active Navigation Antenna

for the B1C Frequency Band

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is applicable to the manufacturers of the Project Approval for application of CTSO authorization (CTSOA) for independent BDS(BeiDou Navigation Satellite System) airborne active navigation antenna for the B1C frequency band. This CTSO specifies the minimum performance standards(MPS) that independent BDS airborne active navigation antenna for the B1C frequency band must first meet for approval and identification with the applicable CTSO marking.

2. Applicability.

This CTSO affects new application submitted after its effective date. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21R4.

3. Requirements

The equipment manufactured on or after the effective date of this CTSO and intended to be marked with this CTSO mark shall meet the minimum performance standards specified in Appendix 1 of this CTSO.

a. Functionality.

This CTSO standard is applicable to the independent BDS airborne active navigation antenna for the B1C frequency band used to receive signals from the BDS and provides signals for the independent BDS airborne navigation equipment used in the en-route phases of the aircraft certified according to CCAR-23, CCAR-25, CCAR-27, CCAR-29 and CCAR-31.

b. Failure Condition Classifications.

(1) Failure of the function defined in Section 3.a is a minor failure condition if it causes erroneous information.

(2) Loss of the function defined in Section 3.a is a failure condition without safety impact.

(3) Design the system to at least these failure condition classifications.

c. Functional Qualification.

The test conditions specified in Appendix 1 of this CTSO shall prove that the performance of the equipment meets the requirements.

d. Environmental Qualification.

According to the test conditions in Appendix 1 of this CTSO, the standard environmental conditions and test procedures applicable to the equipment shall be adopted to prove that the performance of the equipment meets the requirements. In addition to RTCA/DO-160G, the applicant may also adopt other applicable standard environmental conditions and test procedures.

Note 1: Some performance requirements in Appendix 1 are not required to be tested under all conditions contained in RTCA/DO-160G. If it can be shown that these specific performance parameters are not easily affected by environmental conditions according to calculation analysis, comparative analysis of similar designs, etc. and that the performance levels specified in Appendix 1 are not significantly reduced by exposure to such special environmental conditions, then this Class tests can be ignored.

e. Software Qualification.

If the article includes software, develop the software according to RTCA/DO-178C, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 13, 2011, including referenced supplements as applicable, to at least the software level consistent with the failure condition classification defined in paragraph 3.b of this CTSO. The applicant may also develop the software according to RTCA/DO-178B, dated December 1, 1992.

f. Electronic Hardware Qualification.

If the article includes complex custom airborne electronic hardware, develop the component according to RTCA/DO-254, dated April 19, 2000, *Design Assurance Guidance for Airborne Electronic Hardware*, to at least the design assurance level consistent with the failure condition classification defined in paragraph 3.b of this CTSO. For custom airborne electronic hardware determined to be simple, RTCA/DO-254, paragraph 1.6 applies.

g. Deviations.

For using alternative or equivalent means of compliance to the criteria in this CTSO, the applicant must show that the equipment maintains an equivalent level of safety. Apply for a deviation under the provision of 21.368(a) in CCAR-21R4.

4. Marking.

a. Mark at least one major component permanently and legibly with all the information in 21.423(b) of CCAR-21R4. 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 CTSO number:

- (1) Each component that is easily removable (without hand tools);
- (2) Each subassembly of the article that manufacturer determined

may be interchangeable.

c. If the article includes software and/or airborne electronic hardware, then the article part numbering scheme must identify the software and airborne electronic hardware configuration. The part numbering scheme can use separate, unique part numbers for software, hardware, and airborne electronic hardware.

d. The applicant may use electronic part marking to identify software or airborne electronic hardware components by embedding the identification within the hardware component itself (using software) rather than marking it on the equipment nameplate. If electronic marking is used, it must be readily accessible without the use of special tools or equipment.

5. Application Data Requirements.

The applicant must furnish the responsible certification personnel with the related data to support design and production approval. The application data include a statement of conformance as specified in section 21.353(a)(1) in CCAR-21R4 and one copy each of the following technical data:

a. A Manual(s) containing the following:

(1) Operating instructions and equipment limitations sufficient to describe the equipment's operational capability.

(2) Describe in detail any deviations.

(3) Installation procedures and limitations sufficient to ensure that the antenna equipment, when installed according to the installation or operational procedures, still meet this CTSO'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 CTSO. Installation of this article requires separate approval.”

(4) For each unique configuration of software and airborne electronic hardware, reference the following:

(i) Software part number including revision and design assurance level;

(ii) Airborne electronic hardware part number including revision and design assurance level;

(iii) Functional description.

(5) 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-160G, *Environmental Conditions and Test Procedures for Airborne Equipment*, Appendix A.

(6) Schematic drawings, wiring diagrams, and any other documentation necessary for installation of the antenna equipment.

(7) List of replaceable components, by part number, that makes up

the airborne equipment. Include vendor part number cross-references, when applicable.

Note 1: Identify the antenna minimum radiation pattern gain at 5 degrees and the antenna minimum G/T in the installation instructions so that receiver manufacturers can take advantage of performance better than the minimum requirement. Documenting the improved performance facilitates the antenna/receiver installation and integration.

Note 2: Identify the antenna nominal amplifier gain and tolerance in the installation instructions. Receiver manufacturers need this information to define installation instructions that integrate the antenna and receiver.

b. Instructions covering periodic maintenance, calibration, and repair, for the continued airworthiness of the antenna equipment. Include recommended inspection intervals and service life, as appropriate.

c. If the article includes software: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary.

d. If the article includes hardware: a plan for hardware aspects of certification (PHAC), hardware configuration index and hardware completion accomplishment summary.

e. A drawing depicting how the article will be marked with the

information required by paragraph 4 of this CTSO.

f. Identify functionality or performance contained in the article not evaluated under paragraph 4 of this CTSO (that is, non-CTSO functions). Non-CTSO functions are accepted in parallel with the CTSO authorization. For those non-CTSO functions to be accepted, the applicant must declare these functions and include the following information with CTSO application:

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

(2) Installation procedures and limitations sufficient to ensure that the non-CTSO function(s) meets the declared functions and performance specification(s) described in paragraph 5.f.(1).

(3) Continued airworthiness requirements for non-CTSO functions described in section 5.f.(1) of this CTSO.

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

(5) (if applicable) Test plans, analysis and results, as appropriate, to verify that performance of the hosting CTSO article is not affected by the

non-CTSO function(s).

(6) (if applicable) Test plans, analysis and results, as appropriate, to verify the function and performance of the non-CTSO function(s) as described in paragraph 5.f.(1).

g. The quality system description required by section 21.358 of CCAR-21R4, including functional test specifications. The quality system should ensure that it will detect any change to the approved design that could adversely affect compliance with the CTSO MPS, and reject the article accordingly.

h. Material and process specifications list.

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

j. Manufacturer's CTSO qualification report showing results of testing accomplished according to paragraph 3.c of this CTSO.

6. Manufacturer Data Requirements.

Besides the data given directly to the authorities, have the following technical data available for review by the authorities:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this CTSO.

b. Equipment calibration procedures.

c. Schematic drawings.

d. Wiring diagrams.

- e. Material and process specifications.
- f. The results of the environmental qualification tests conducted according to paragraph 3.d of this CTSO.
- g. If the article includes software, the appropriate documentation defined in the version of RTCA/DO-178 specified by paragraph 3.e of this CTSO, including all data supporting the applicable objectives in Annex A, Process Objectives and Outputs by Software Level.
- h. If the article includes complex custom airborne electronic hardware, the appropriate hardware life cycle data in combination with design assurance level, as defined in RTCA/DO-254, Appendix A, Table A-1. For simple custom airborne electronic hardware, the following data: test cases or procedures, test results, test coverage analysis, tool assessment and qualification data, and configuration management records, including problem reports.
- i. If the article contains non-CTSO function(s), the applicant must also make available items 6.a through 6.h as they pertain to the non-CTSO function(s).

7. Furnished Data Requirements.

- a. If furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy or technical data and information specified in paragraphs 5.a and 5.b of this CTSO. Add any data needed for the proper installation, certification, use,

or for continued compliance with the CTSO, of the antenna equipment.

b. If the article contains declared non-CTSO function(s), include one copy of the data in paragraphs 5.f.(1) through 5.f.(4).

8. Availability of Referenced Documents.

Order RTCA documents from:

Radio Technical Commission for Aeronautics, Inc.

1150 18th Street NW, Suite 910, Washington D.C. 20036

You may also order them online from the RTCA Internet website at:

www.rtca.org.

Appendix 1 Minimum Performance Standards for Independent BDS Airborne Active Navigation Antenna for the B1C Frequency Band

Independent BDS airborne active navigation antenna for the B1C frequency band shall meet the requirements of Chapter 2 of RTCA/DO-301 “*Minimum Operational Performance Standards (MOPS) for Global Navigation Satellite System (GNSS) Airborne Active Antenna Equipment for the L1 Frequency Band*”(excluding Section 2.3) and the following modifications.

1. Modify 2.1.2 to “The antenna shall perform its intended function(s), as defined by the manufacturer, and its proper use shall not create a hazard to other airspace users”.
2. Modify the title of 2.1.3 to “Radio Regulation”. Modify 2.1.3 to “All equipment shall comply with the Radio Regulations of the People's Republic of China”.
3. Modify the note in 2.1.4 to “Compliance can be demonstrated through CCAR-25-R4 Appendix F”.
4. Modify the title of 2.2.1.1 to “BDS B1C operating frequency”.
5. Modify the output VSWR for antenna unit to “ ≤ 2.0 ” in 2.2.2.
6. In 2.2.5, delete the requirements of “Over the frequency range 1575.42 ± 2 MHz, the 5 degree elevation G/T shall not be less than that -31.6 dB/K over all azimuth angles and over the full environment temperature range”. Delete “See Appendix A for further details”.

7. 2.2.6.1 Minimum Boresight Total Transducer Gain, modify the test frequency of gain to $1575.42\text{MHz}\pm 7.5\text{MHz}$.
8. 2.2.6.2 Gain of active sub-assembly, modify the test frequency of gain to $1575.42\text{MHz}\pm 7.5\text{MHz}$.
9. Delete requirements of the Group Delay Versus Aspect Angle in 2.2.11.2.
10. Delete “2.2.11.2” from “Insert the delay values in the appropriate limit formula in Section 2.2.11 and verify that the requirements of Sub-sections 2.2.11.1 and 2.2.11.2 are met.” in 2.4.2.2.6.
11. Modify DO-160E in 2.4.2.6 to DO-160G.
12. Modify $1575.42\text{MHz}\pm 2\text{MHz}$ in item (7) of the test in 2.4.3.2.1 to $1575.42\text{MHz}\pm 7.5\text{MHz}$.

(The English version is for reference only. In case of any discrepancy or ambiguity of meaning between this English translation and the Chinese version, the latter shall prevail.)