English Translation Version for Reference Only

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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.

Very High Frequency (VHF) Digital Link (VDL) Mode 2 Communications Equipment

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers applying for very high frequency (VHF) digital link (VDL) Mode 2 communications equipment CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards(MPS) that very high frequency (VHF) digital link (VDL) Mode 2 communications equipment 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.

New models of VDL Mode 2 communication equipment identified and manufactured on or after the effective date of this CTSO must meet the MPS qualification and documentation requirements in Section 2.1 and 2.2 of RTCA/DO-281B, Minimum Operational Performance Standards for Aircraft VDL Mode 2 Physical, Link, and Network Layer, dated March 21, 2012 for the applicable Equipment Class and Avionics Architecture Class. The Equipment Class and Avionics Architecture Class are defined in Appendix 1 of this CTSO, and Appendix B of RTCA/DO-281B correlates the applicable requirements to avionics architecture classes.

Note: RTCA/DO-281B was developed jointly with EUROCAE/ED-92B to ensure the two standards are equivalent, with common requirements and qualification tests.

a. Functionality. This CTSO's standards apply to equipment intended for aircraft supporting VDL Mode 2 communications.

b. Failure Condition Classifications.

(1) Failure of the function defined in paragraph 3.a resulting in an undetected corrupted data link message is a minor failure condition.

Note: The minor failure condition classification is based upon the assumption that the Open Systems Interconnection (OSI) layers above the VDL Mode 2 stack detect errors that are caused by the function defined in

paragraph 3.a.

(2) Loss of the function defined in paragraph 3.a is a minor failure condition.

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

c. Functional Qualification. Demonstrate the required functional performance under the test conditions specified in Section 2.4 of RTCA/DO-281B.

d. Environmental Qualification. Demonstrate the required performance under the test conditions specified in Section 2.3 of RTCA/DO-281B using standard environmental conditions and test procedures appropriate for airborne equipment. You may use a different standard environmental condition and test procedure than RTCA, Inc. document RTCA/DO-160G, Environmental Conditions and Test Procedures for Airborne Equipment, provided the standard is appropriate for the VDL Mode 2 communications equipment developed under this CTSO.

Note: The use of RTCA/DO-160D (with Changes 1 and 2 only, incorporated) or earlier versions is generally not considered appropriate and will require substantiation via the deviation process as discussed in paragraph 3.f of this CTSO.

e. Software Qualification. If the article includes software, develop

the software according to RTCA, Inc. document RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, dated December 1, 1992 to at least the software level consistent with the failure condition classification defined in paragraph 3.b of this CTSO.

Note: The certification liaison process objectives will be considered satisfied after CAAC review of the applicable life cycle data.

f. 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. Electronic part marking may be used 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 VDL Mode 2 communications equipment, when installed according to the installation or operational procedures, still meets 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; and

(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 VDL Mode 2 communications equipment.

(7) List of replaceable components, by part number, that makes up the VDL Mode 2 communications equipment. Include vendor part number cross-references, when applicable.

(8) Document equipment class and avionics architecture class of the VDL Mode 2 communications equipment to sufficiently describe the equipment's operational capability. An explanation of the equipment and avionics architecture classes are contained within Appendix 1 of this CTSO.

b. Instructions covering periodic maintenance, calibration, and repair, for the continued airworthiness of VDL Mode 2 communications 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 (SCI), and software accomplishment summary (SAS).

d. A drawing depicting how the article will be marked with the information required by paragraph 4 of this CTSO.

e. Identify functionality or performance contained in the article not evaluated under paragraph 3 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, you must declare these functions and include the following information with your

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.

Note: Examples of non-CTSO functionality are other VHF digital link implementations such as: Mode A, aircraft communications addressing and reporting system (ACARS), ACARS over aviation VHF link control (AOA), and functionality above the VDL Mode 2 protocol layers (see Section 1.2 of RTCA/DO-281B).

(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.e.(1).

(3) Instructions for continued performance applicable to the non-CTSO function(s) described in paragraph 5.e.(1).

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

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

f. 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.

g. Material and process specifications list.

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

i. 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 RTCA/DO-178B including all data supporting the applicable objectives in RTCA/DO-178B Annex A, Process Objectives and Outputs by Software Level.

h. If the article contains non-CTSO function(s), applicant must also make available items 6.a through 6.g 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 on-line access to the data in paragraphs 5.a and 5.b of this CTSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the CTSO, of the VDL Mode 2 communications equipment

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

8. Availability of Referenced Documents.

a. 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 www.rtca.org.

b. Order EUROCAE documents from:

European Organisation for Civil Aviation Equipment

102 rue Etienne Dolet, 92240 Malakoff, France

You may also order them online from www.eurocae.net.

Appendix 1. Equipment and Avionics Architecture Classes for VDL M2

1.1 Equipment Class. Three different equipment classes are defined in Section 2.1.8 of RTCA/DO-281B. Appendix B of RTCA/DO-281B correlates the applicable set of requirements and qualification tests to each equipment class. The three equipment classes are summarized below:

Table 1. Equipment Class for VDL Mode 2

Equipment Class	Description
F	VDL mode 2 receiver used in a 25 kilohertz (kHz) channel separation environment
7	VDL mode 2 transmitter used in a 25 kHz channel separation environment, intended to operate with a range of 200 nautical miles
8	VDL mode 2 transmitter used in a 25 kHz channel separation environment, intended to operate with a range of 100 nautical miles

1.2 Avionics Architecture Class. Five different avionics architecture classes are defined in Section 2.1.9 of RTCA/DO-281B. VDL Mode 2 equipment is organized according to the Open Systems Interconnection (OSI) reference model of the International Standards Organization (ISO). VDL mode 2 protocol layers and sub-layers are comprised of the physical, media access control (MAC), data link services (DLS), link management entity (LME), subnetwork access protocol (SNAcP) and subnetwork dependent convergence function (SNDCF). Appendix B of

RTCA/DO-281B correlates the applicable set of requirements and qualification tests to each avionics architecture class. Table 2 below presents the five avionics architecture classes and VDL mode 2 functionalities they provide:

Table 2. Avionics Architecture Classes for VDL Mode 2

Avionics Architecture Class	Article Name	VDL Mode 2 Functionality (Layers/Sub Layers)
V (non-ISO 8208)	VDL Mode 2 radio	Article with transceiver and router functionality supporting data communications via a character oriented air-ground subnetwork (e.g. ACARS). OSI Layers: Physical, MAC, DLS, and LME
W (non-ISO 8208)	Communication management unit (CMU)	Router supporting data communications via a character oriented air-ground subnetwork (e.g.ACARS). OSI Layers: DLS (portion), and LME
X (ISO 8208)	VDL Mode 2 radio	Article with transceiver and router functionality supporting data communications via a bit oriented air-ground subnetwork (e.g. ATN). OSI Layers: Physical, MAC, DLS, LME, SNAcP and SNDCF
Y	VHF digital radio (VDR)	Transceiver supporting data communications. OSI Layers: Physical, DLS (portion), and MAC
Z (ISO 8208)	Communication management unit (CMU)	Router supporting data communications via a bit oriented air-ground subnetwork (e.g. ATN). OSI Layers: DLS (portion), LME, SNAcP and SNDCF