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.

VDL Mode 3 Communications Equipment Operating Within the Frequency Range 117.975-137.000 Megahertz

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers applying for the VDL mode 3 communications equipment operating within the frequency range 117.975-137.000 megahertz CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards that the VDL mode 3 communications equipment operating within the frequency range 117.975-137.000 megahertz 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 CTSOA will require a new authorization in accordance with section 21.353 of

CCAR-21-R4.

3. Requirements

a. New models of VDL Mode 3 communications equipment operating within 117.975 and 137.000 MHz identified and manufactured on or after the effective date of this CTSO must meet the MPS in RTCA, Inc. document RTCA/DO-271C, Minimum Operational Performance Standards for Aircraft VDL Mode 3 Transceiver Operating in the Frequency Range 117.975 -137.000 MHz, Section 2, dated November 8, 2005.

b. The MPS allow for different equipment classes as defined by RTCA/DO-271C, Section 2.1.8. There are three equipment classes, summarized below:

Table1 Equipment Classes for VDL Mode 3

Equipment Class	Description
G	VDL Mode 3 receiver used in a 25 kilohertz (kHz) channel separation environment
9	VDL Mode 3 transmitter used in a 25 kilohertz (kHz) channel separation environment and intended to operate with a range of 200 nautical miles
10	VDL Mode 3 transmitter used in a 25 kilohertz (kHz) channel separation environment and intended to operate with a range of 100 nautical miles

(1) In addition to equipment classes above, the MPS allow for different equipment architecture classes as defined by RTCA/DO-271C, Section 2.1.9. Although RTCA/DO-271C defines seven equipment

architecture classes, this CTSO recognizes only the three summarized in Table 2 below.

(2) We expect these equipment architecture classes will also have functionality not covered by this CTSO. Identify and describe all additional functionality according to paragraph 5.b of this CTSO. Examples of additional functionality are other VHF digital link modes of operation such as Mode A, aeronautical operational control communications (ACARS), and controller – pilot data link communication.

Table 2 Equipment Architecture Classes for VDL Mode 3

Equipment Architecture Class	Equipment Name	Services	VDL Mode 3 Functionality (Layers/Sub Layers)
IB0	VHF digital radio (VDR)	Voice (basic)	Physical, MAC and a portion of LME
IV9	VHF digital radio (VDR)	Voice (basic and enhanced)	Physical, MAC and a portion of LME
SL0	VHF digital radio (VDR)	Voice (basic and enhanced) and data	Physical, MAC and a portion of LME and DLS

c. Functionality. This CTSO's standards apply to equipment intended to operate within 117.975 to 137.000 MHz. VDL Mode 3 equipment covered by this CTSO is primarily intended for air traffic services (ATS) safety communications. Equipment developed under this CTSO will work with aircraft equipment used to communicate tactical and strategic

information.

d. Failure Condition Classification. Failure of the function defined in paragraph 3.a, 3.b and 3.c of this CTSO is a major failure condition. Develop the system to, at least, the design assurance level equal to this failure condition classification. See Appendix 1 for additional guidance on design assurance levels and quantitative safety objectives.

e. Functional Qualification. Demonstrate the required performance under the test conditions in RTCA/DO-271C, Section 2.4. RTCA/DO-271C, Appendix B, correlates the verification tests to equipment architecture classes. The table in Appendix B simplifies the complexity introduced by having multiple equipment architecture classes that vary in VDL Mode 3 functionality.

f. Environmental Qualification. Demonstrate the required environmental performance under the test conditions specified in RTCA/DO-271C, Section 2.3. Environmental conditions used in these tests are in RTCA/DO-160E, Environmental Conditions and Test Procedures for Airborne Equipment, dated December 9, 2004.

g. Software Qualification. If the article includes a digital computer, develop the software according to RTCA document RTCA/DO-178B or EUROCAE document ED-12B, Software Considerations in Airborne Systems and Equipment Certification, both dated December 1, 1992.

h. Electronic Hardware Qualification. If the article includes a

complex custom micro-coded component, develop the component to the guidance in advisory circular (AC) 20-152, RTCA, Inc. Document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware. The hardware design assurance level should be consistent with the failure condition classification defined in paragraph 3.d of this CTSO.

i. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in this CTSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under section 21.368(a) of CCAR-21-R4.

4. Marking.

a. Mark at least one major component permanently and legibly with all the information in CCAR-21-R4 21.423(b), except for the following:

(1) CCAR-21-R4 21.423(b)(2). Use the name, type, and part number. Do not use the optional model number; and

(2) CCAR-21-R4 21.423(b)(3). Use the date of manufacture. Do not use the optional 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 interchangeable element, and

(3) Each subassembly of the article that you determined may be interchangeable.

c. 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, approved to different software levels, must be differentiated by part number.

d. Describe any deviations that have been granted in the installation procedures and limitations of 5.b of this CTSO. You must, however, mark the component with the drawing number that provides the installation procedures and limitations.

e. Describing additional functions in the installation procedures and limitations of 5.b of this CTSO qualifies as an alternative to marking the component. You must, however, mark the component with the drawing number that provides the installation procedures and limitations.

f. To include other marking requirements unique to this CTSO, you can use all or part of the statement: Optional marking is permitted to allow aircraft-specific or operational-specific installation limitations, such as: “FOR USE ON {insert aircraft type or serial number} ONLY,” “FOR USE ON AIRCRAFT USED IN PART {insert number}

OPERATIONS ONLY,” or “SEE DRAWING NO. XYZ FOR INSTALLATION LIMITATIONS.”

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. Operating instructions and equipment limitations in an installation/instruction manual (IM), sufficient to describe the equipment’s operational capability. Describe any deviations in detail. 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 VHF digital link (VDL) Mode 3 communications equipment operating within 117.975 to 137.000 MHz, when installed according to the installation procedures, continues to meet the requirements of this CTSO and will meet the airworthiness and operating requirements appropriate for the intended type of aircraft and operation. The limitations include:

(1) A note with the following statement:

The conditions and tests for CTSO 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 CTSO standards. CTSO articles must have separate approval for installation in an aircraft.

(2) Development assurance level(s) for the functions defined in paragraphs 3.a, 3.b and 3.c, this CTSO.

(3) Quantitative safety objectives for the functions defined in paragraphs 3.a, 3.b and 3.c, this CTSO

(4) When applicable, identify the equipment as an incomplete system or that the equipment accomplishes additional functions beyond that described in paragraphs 3.a, 3.b and 3.c of this CTSO. Also describe the functions provided by the equipment.

(5) Any unique aspects of the installation, including those relevant to any deviations that may have been granted.

(6) The equipment class(es) and architecture class(es) that the equipment has been qualified to perform and the functions provided by these class(es). Write the description so an installer of the equipment will know the equipment being installed meets the intentions of the installation.

c. Schematic drawings of the installation procedures.

d. Wiring diagrams of the installation procedures.

e. Equipment specification.

f. List of components, by part number, that make up the VHF digital link (VDL) Mode 3 communications equipment operating within 117.975 to 137.000 MHz complying with the standards prescribed under this CTSO. Include vendor part number cross-references, when applicable.

g. A component maintenance manual (CMM), covering periodic maintenance, calibration, and repair, for the continued airworthiness of installed VHF digital link (VDL) Mode 3 communications equipment operating within 117.975 to 137.000 MHz. Include recommended inspection intervals and service life. Describe the details of deviations granted, as noted in paragraph 5.a of this CTSO.

h. Material and process specifications list.

i. The quality control system (QCS) description required by CCAR-21-R4 21.358, including functional test specifications. The QCS should ensure that you will detect any change to the equipment that could adversely affect compliance with the CTSO MPS, and reject the item accordingly.

j. Manufacturer’s CTSO qualification test report.

k. Nameplate drawing with the information required by paragraph 4 of this CTSO.

l. List of all drawings and processes (including revision level) that

define the article’s design. For a minor change, follow the directions in CCAR 21.369. Show any revisions to the drawing list only on our request.

m. An environmental qualifications form as described in the environmental qualifications document referenced in paragraph 3.f of this CTSO for each component of the system.

n. 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.

o. If the article includes a complex custom micro-coded component: a plan for hardware aspects of certification (PHAC), hardware verification plan; top-level drawing, and hardware accomplishment summary. We recommend that you submit the PHAC early in the software development process. Early submittal allows us to quickly resolve issues.

6. Manufacturer Data Requirements.

Besides the data given directly to us, 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. Corrective maintenance procedures within 12 months after CTSOA.

d. Schematic drawings.

e. Wiring diagrams.

f. Material and process specifications.

g. The results of the environmental qualification tests conducted per RTCA/DO-160E.

h. If the article includes a digital computer, the appropriate documentation defined in RTCA/DO-178B, including all data supporting the applicable objectives in Annex A, Process Objectives and Outputs by Software Level.

i. If the article includes a complex micro-coded component, the appropriate hardware life cycle data in combination with design assurance level, as defined in RTCA/DO-254, Appendix A, Table A-l.

7. Furnished Data Requirements.

If furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy of the data in paragraphs 5.a through 5.g. Add any other data needed for the

proper installation, certification, use, or for continued airworthiness, of VDL Mode 3 communications equipment operating within 117.975 to 137.000 MHz.

8. How to Get Referenced Documents.

a. Order copies of RTCA documents from RTCA Inc., 1828 L Street NW, Suite 805, Washington, D.C. 20036-4001. Copies may also be obtained from the RTCA Internet website at: www.rtca.org.

b. Order copies of SAE documents from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096. Copies may also be ordered from the SAE Internet website at: www.sae.org.

APPENDIX 1. Additional Guidance on Design Assurance Levels And Quantitative Safety Objectives

1.1 PURPOSE. Although the major hazard classification remains the same regardless of an aircraft installation, the design assurance levels and quantitative safety objectives commensurate to the hazard classification may vary for different aircraft installations.

1.2 DESIGN ASSURANCE LEVELS. You'll find guidance on establishing design assurance levels for different installations in the latest versions of:

- For a system, see SAE International's Aerospace Recommended Practice (ARP) 4754, Certification Considerations for Highly Integrated or Complex Aircraft Systems, dated June 27, 1996.
- For hardware, see RTCA/DO-254, Design Assurance Guidance For Airborne Electronic Hardware, dated April 19, 2000.
- For software, see RTCA/DO-178B and EUROCAE document ED-12B, Software Considerations In Airborne Systems and Equipment Certification, dated December 1, 1992.

1.3 QUANTITATIVE SAFETY OBJECTIVES. You'll find guidance on establishing quantitative safety objectives for different installations in the latest versions of:

- AC 23.1309-1, latest revision, Equipment, Systems And Installations In Part 23 Airplanes,

- AC 25.1309-1, latest revision, System Design And Analysis,
- AC 27-1, latest revision, Certification of Normal Category Rotor craft, and
- AC 29-2, latest revision, Certification Of Transport Category Rotor craft, for aircraft certificated under the provisions of CCAR 23, 25, 27 or 29.