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STN	**Režim 4 digitálneho spoja VHF (VDL) rádiových zariadení vzduch-zem a vzduch-vzduch. Technické charakteristiky a meracie metódy na letecké pohyblivé (palubné) zariadenia. Časť 1: Fyzická vrstva.**	**STN EN 302 842-1 V1.3.1** 87 2842

VHF air-ground and air-air Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for aeronautical mobile (airborne) equipment; Part 1: Physical layer

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Contents

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Aeronautics (AERO).

The present document is part 1 of a multi-part deliverable covering the VHF air-ground and air-air Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for aeronautical mobile (airborne) equipment, as identified below:

Part 1: "Physical layer";

Part 2: "General description and data link layer";

Part 3: "Additional broadcast aspects";

Part 4: "Point-to-point functions".

The present document is accompanied by an equivalent ground-based standard, ETSI EN 301 842 [i.7] parts 1 to 5, covering the VHF air-ground Data Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for ground-based equipment.

NOTE: Minimum Operational Performance Specifications (MOPS) are also being developed for VDL Mode 4. EUROCAE have previously published Interim MOPS for VDL Mode 4 [i.2] which are a sub set of ETSI EN 302 842-1 (the present document), ETSI EN 302 842- 2 [7], ETSI EN 302 842-3 [8] and ETSI EN 302 842-4 [9]. ETSI EN 302 842-1 (the present document), ETSI EN 302 842-2 [7], ETSI EN 302 842-3 [8] and ETSI EN 302 842-4 [9] comply with the requirements of CEC Mandate M/318 [i.3].

National transposition dates	
Date of adoption of this EN:	6 April 2015
Date of latest announcement of this EN (doa):	31 July 2015
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2016
Date of withdrawal of any conflicting National Standard (dow):	31 January 2017

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document states the technical specifications for Very High Frequency (VHF) Digital Link (VDL) Mode 4 aeronautical mobile (airborne) radio transmitters, transceivers and receivers for air-ground and air-air communications operating in the VHF band, using Gaussian Filtered Frequency Shift Keying (GFSK) modulation with 25 kHz channel spacing and capable of tuning to any of the 25 kHz channels from 112,000 MHz to 136,975 MHz as defined in ICAO VDL SARPs [2].

The present document may be used to produce tests for the assessment of the performance of the equipment. The performance of the equipment submitted for type testing should be representative of the performance of the corresponding production model.

The present document has been written on the assumption that:

- the type test measurements will be performed only once, in an accredited test laboratory and the measurements accepted by the various authorities in order to grant type approval;
- if equipment available on the market is required to be checked it may be tested in accordance with the methods of measurement specified in the present document or a documented alternative approved by the certifying authority.

1 Scope

The present document applies to the following radio equipment types:

- Very High Frequency (VHF) Digital Link (VDL) Mode 4 aeronautical mobile (airborne) radio transmitters, transceivers and receivers for air-ground and air-air communications operating in the VHF band, using Gaussian Filtered Frequency Shift Keying (GFSK) modulation with 25 kHz channel spacing and capable of tuning to any of the 25 kHz channels from 112,000 MHz to 136,975 MHz as defined in ICAO VDL SARPs [2].

The present technical document provides part 1 of the technical specifications.

The present document is designed to ensure that equipment certified to it will be compatible with the relevant ICAO VDL SARPs [2] and ICAO VDL4 Technical Manual [1].

Manufacturers should note that in future the tuning range for the transmitter and receiver may cover any 25 kHz channel from 108,000 MHz to 111,975 MHz.

The present document applies to "aeronautical mobile (airborne and in some cases ground vehicles)" equipment which will hereinafter be referred to as "mobile" equipment.

The scope of the present document is limited to mobile stations. The equivalent specification for ground stations is ETSI EN 301 842 [i.7].

The VDL Mode 4 system provides digital communication exchanges between aircraft and ground-based systems and other aircraft supporting surveillance and communication applications. The supported modes of communication include:

- broadcast and point-to-point communication;
- broadcast services including Automatic Dependent Surveillance - Broadcast (ADS-B), Traffic Information Service - Broadcast (TIS-B) and Flight Information Service - Broadcast (FIS-B) capabilities;
- air-air and ground-air services;
- operation without ground infrastructure.

The present document is derived from the specifications:

- ICAO VDL4 Technical Manual [1] and ICAO VDL SARPs [2] produced under the auspices of the International Civil Aviation Organization (ICAO).
- Other relevant standards as defined in clause 2.

It is envisaged that manufacturers may provide equipment supporting:

- broadcast services only;
- point-to-point services only;
- both broadcast and point-to-point services.

The present document deals with tests of the physical layer necessary to support all types of equipment.

The present document is organized as follows:

- clause 2 provides references to relevant documents;
- clause 3 provides general definitions, abbreviations and symbols used;
- clause 4 provides a general description and architecture of VDL Mode 4;
- clause 5 provides functional specifications applicable to the physical layer including transmitter/receiver requirements and the modulation scheme;
- clause 6 provides VDL Mode 4 equipment requirements;

- clause 7 provides general design requirements;
- clause 8 provides environmental test requirements;
- clause 9 provides detailed test procedures for the physical layer;
- clause 10 provides installed equipment requirements;
- annex A provides a detailed cross-reference to the relevant requirements contained in reference [1];
- annex B provides an assessment of VDL Mode 4 Link Budget;
- annex C provides a Bibliography;

The full physical layer tests are provided which correspond closely to the standard set of tests used for other VDL systems.

NOTE: Flight tests are defined in ETSI EN 302 842-2 [7].

Mandating and recommendation phrases

a) "Shall"

- The use of the word "Shall" indicates a mandated criterion; e.g. compliance with the particular procedure or specification is mandatory and no alternative may be applied.

b) "Should"

- The use of the word "Should" (and phrases such as "It is recommended that...", etc.) indicate that though the procedure or criterion is regarded as the preferred option, alternative procedures, specifications or criteria may be applied, provided that the manufacturer, installer or tester can provide information or data to adequately support and justify the alternative.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ICAO Doc 9816 (First Edition 2004): "Manual on VHF Digital Link (VDL) Mode 4, Part 2: Detailed Technical Specifications".

[2] ICAO Annex 10 to the Convention on International Civil Aviation: "Aeronautical Telecommunications, Volume III: Communication Systems, Part I: Digital Data Communication Systems, chapter 6", including Amendment 88 (applicable 14/11/13).

[3] ISO/IEC 7498-1 (1994): "Information technology -- Open Systems Interconnection -- Basic Reference Model: The Basic Model".

[4] ISO/IEC 10731 (1994): "Information technology -- Open Systems Interconnection -- Basic Reference Model -- Conventions for the definition of OSI services".

[5] EUROCAE ED-12C/RTCA DO-178C: "Software Considerations in Airborne Systems and Equipment Certification", January 2012.

[6] EUROCAE ED-14G/RTCA DO-160G: "Environmental Conditions and Test Procedures for Airborne Equipment", May 2011.

[7] ETSI EN 302 842-2 (V1.4.1): "VHF air-ground and air-air Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for aeronautical mobile (airborne) equipment; Part 2: General Description and data link layer".

[8] ETSI EN 302 842-3 (V1.4.1): "VHF air-ground and air-air Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for aeronautical mobile (airborne) equipment; Part 3: Additional broadcast aspects".

[9] ETSI EN 302 842-4 (V1.3.1): "VHF air-ground and air-air Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for aeronautical mobile (airborne) equipment; Part 4: Point-to-point functions".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 300 113-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Radio equipment intended for the transmission of data (and/or speech) using constant or non-constant envelope modulation and having an antenna connector; Part 1: Technical characteristics and methods of measurement".

[i.2] EUROCAE ED-108A: "MOPS for VDL Mode 4 Aircraft Transceiver for ADS-B", October 2005.

[i.3] CEC Mandate M/318: "Mandate to CEN/CENELEC/ETSI for standardisation in the field of air traffic management systems and Galileo local components".

[i.4] EASA CS-25: "Large Aeroplanes" Appendix F (previously Joint Airworthiness Requirements (JAR), Part 25).

[i.5] EUROCAE ED-23C: "MOPS for airborne VHF receiver - transmitter operating in the frequency range 117.975-137.000 MHz".

[i.6] RTCA DO-224C: "Signal-in-Space Minimum Aviation System Performance Standards (MASPS) for Advanced VHF Digital Data Communications Including Compatibility with Digital Voice Techniques".

[i.7] ETSI EN 301 842 (all parts): "VHF air-ground Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for ground-based equipment".

[i.8] ITU Radio Regulations. (2012).

[i.9] Agilent Application Note (AN 1303): "Spectrum Analyser Measurements and Noise", 11th February 2003.

[i.10] TIA/EIA/TSB-88-A (1999): "Performance in Noise and Interference-Limited Situations - Recommended Methods for Technology-Independent Modeling, Simulation, and Verification".