

ETSI EN 302 842-1 V1.2.2 (2010-12)

European Standard (Telecommunications series)

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

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ETSI EN 302 842-1 V1.2.2 \(2010-12\)](https://standards.iteh.ai/catalog/standards/etsi/6d6420a9-35e2-4bb7-ba24-147465e91a86/etsi-en-302-842-1-v1-2-2-2010-12)

<https://standards.iteh.ai/catalog/standards/etsi/6d6420a9-35e2-4bb7-ba24-147465e91a86/etsi-en-302-842-1-v1-2-2-2010-12>



Reference

REN/AERO-00007-1

Keywords

aeronautical, digital, radio, testing, VHF

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

(<https://standards.iteh.ai>)
Document Preview

Important notice

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:

http://portal.etsi.org/chaicor/ETSI_support.asp

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2010.
All rights reserved.

DECTTM, PLUGTESTSTM, UMTSTM, TIPHONTM, the TIPHON logo and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.

3GPPTM is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

LTETM is a Trade Mark of ETSI currently being registered for the benefit of its Members and of the 3GPP Organizational Partners.

GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	6
Foreword.....	6
Introduction	7
1 Scope	8
2 References	10
2.1 Normative references	10
2.2 Informative references.....	11
3 Definitions and abbreviations.....	11
3.1 Definitions.....	11
3.1.1 Basic reference model definitions.....	11
3.1.2 Service conventions definitions	11
3.1.3 General definitions.....	12
3.2 Abbreviations	15
4 General description and architecture of VDL Mode 4	16
4.1 General	16
5 VDL mode 4 physical layer functional specifications	17
5.1 Overview	17
5.1.1 Functions	17
5.1.2 Data reception	17
5.1.3 Data transmission.....	17
5.2 Modulation scheme	17
6 VDL Mode 4 equipment requirements.....	17
6.1 Receiver requirements	18
6.1.1 Receiver operating range	18
6.1.2 BER requirement	18
6.1.3 Reference signal level	18
6.1.4 Sensitivity	18
6.1.5 Adjacent channel rejection.....	19
6.1.6 Receiver performance in the presence of strong signals inside the VHF aeronautical band.....	19
6.1.7 Receiver performance in the presence of strong signals outside the VHF aeronautical band.....	19
6.1.8 Desired signal dynamic range.....	20
6.1.9 Symbol rate capture range	20
6.1.10 Frequency capture range.....	20
6.1.11 Doppler rate	20
6.1.12 Co-channel interference	20
6.1.13 Conducted spurious emission	21
6.1.14 FM broadcast intermodulation.....	21
6.1.14.1 Radio frequencies in the band 117,975 MHz to 137 MHz.....	21
6.1.15 In-band intermodulation	21
6.2 Transmitter requirements	22
6.2.1 Transmitter operating range.....	22
6.2.2 Channel bit rate.....	22
6.2.3 Manufacturer's declared output power.....	22
6.2.4 RF power rise time.....	22
6.2.5 RF power release time	23
6.2.6 Spurious emissions	23
6.2.7 Adjacent channel power.....	24
6.2.8 Wide-band noise	24
6.2.9 Load VSWR capability	25
6.2.10 Adjacent channel transient power.....	25
6.2.11 Frequency tolerance	25
6.2.12 Start of transmission	25

6.2.13	Structure of bursts.....	25
6.3	Transceiver requirements	26
6.3.1	Automatic transmitter shut-down	26
6.3.2	Tuning time.....	26
6.3.3	Receiver to transmitter turnaround time	26
6.3.4	Transmitter to receiver turnaround time	26
6.3.5	Short power interrupt.....	26
6.3.6	Demodulator action.....	26
6.3.7	System timing requirements	27
6.3.8	Reservation table stored in memory	27
6.3.9	Failure of associated equipment.....	27
6.3.10	Simultaneous reception.....	27
7	General design requirements.....	27
7.1	Controls and indicators.....	27
7.2	Class of emission and modulation characteristics	27
7.3	Warm up	27
7.4	Airworthiness	28
7.5	Intended function.....	28
7.6	International Telecommunications Union Regulations	28
7.7	Fire protection	28
7.8	Operation of controls.....	28
7.9	Accessibility of controls	28
7.10	Effects of tests	28
7.11	Failure of VDL Mode 4 equipment	28
7.12	Software management	28
7.13	Transceiver configuration.....	29
7.14	Provision for multiple redundant VDL4 transceivers.....	29
7.15	Reception capability.....	29
7.16	Transmission capability.....	29
7.17	Monitoring of proper operation	30
7.18	Power-up self test	30
8	Environmental test requirements.....	30
8.1	Introduction	30
8.2	Receiver.....	31
8.3	Transmitter	33
9	Detailed test procedures for the physical layer.....	35
9.1	General requirements	35
9.1.1	Test conditions.....	35
9.1.2	Alignment, adjustment and calibration prior to test.....	35
9.1.3	Recording of test results	35
9.1.4	Connected load	35
9.1.5	Test instrument precautions	35
9.1.6	Simultaneous application of two signals to the receiver input.....	36
9.1.7	Test frequencies	36
9.1.8	Equipment configuration	36
9.1.9	Detailed physical and MAC layer test procedures	36
9.2	Receiver.....	36
9.2.1	BER test	36
9.2.2	Sensitivity	38
9.2.3	Adjacent Channel Rejection (ACR).....	38
9.2.4	Rejection of signals in the VHF aeronautical band.....	39
9.2.5	Rejection of signals outside the VHF aeronautical band	40
9.2.6	Desired signal dynamic range.....	41
9.2.7	Symbol rate capture range	41
9.2.8	Frequency capture range.....	42
9.2.9	Doppler rate	42
9.2.10	Co-channel interference	43
9.2.11	Conducted spurious emission	43
9.2.12	FM broadcast intermodulation.....	44
9.2.13	In-band intermodulation	45

9.3	Transmitter	46
9.3.1	Channel bit rate	46
9.3.2	Manufacturer's declared output power	46
9.3.3	RF power rise time	47
9.3.4	RF power release time	47
9.3.5	Spurious emissions	48
9.3.6	Adjacent channel power	48
9.3.6.1	Method of measurement for the first adjacent channel	48
9.3.6.2	Method of measurement for the second adjacent channel	49
9.3.6.3	Method of measurement for the fourth adjacent channel	50
9.3.6.4	Alternative measurement procedure for Adjacent Channel Power (ACP)	51
9.3.7	Wideband noise	52
9.3.8	Load VSWR capability	53
9.3.9	Adjacent channel transient power	54
9.3.10	Frequency tolerance	55
9.4	Transceiver	55
9.4.1	Tuning time	55
9.4.2	Receiver to transmitter turn-around time	55
9.4.3	Transmitter to receiver turn-around time	56
10	Installed equipment requirements	56
10.1	Introduction	56
10.2	Equipment installation	56
10.2.1	Aircraft environment	56
10.2.2	Failure protection	56
10.2.3	Aircraft power source	57
10.3	Installed equipment performance requirements	57
10.3.1	Dynamic response	57
10.3.2	Interference effects	57
10.3.3	Regular maintenance	57
10.4	Conditions of test	57
10.4.1	Power input	57
10.4.2	Associated equipment or systems	57
10.4.3	Environment	57
10.5	Test procedures for installed equipment performance	58
10.5.1	Ground test procedures	58
10.5.1.1	Conformity inspection	58
10.5.1.2	Interference tests	58
10.5.1.3	Power supply fluctuation test	58
10.5.1.4	Reception	58
10.5.1.5	Transmission	58
10.5.1.6	Functional behaviour tests	59
10.5.1.7	Interface conformance tests	59
10.5.2	Flight test procedures	59
10.5.2.1	Interference effects	59
10.5.2.2	System performance	60
Annex A (informative):	Cross reference matrix	61
Annex B (informative):	VDL Mode 4 link budget	64
Annex C (informative):	Bibliography	71
History		74

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://webapp.etsi.org/IPR/home.asp>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This European Standard (Telecommunications series) 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, EN 301 842 [10] 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 EN 302 842-1, 2 [7], 3 [8] and 4 [11]. EN 302 842-1, 2 [7], 3 [8] and 4 [11] complies with the requirements of CEC Mandate M/318 [i.3].

National transposition dates

Date of latest announcement of this EN (doa):	31 March 2011
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 September 2011
Date of withdrawal of any conflicting National Standard (dow):	30 September 2011

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 118,000 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.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ETSI EN 302 842-1 V1.2.2 \(2010-12\)](https://standards.iteh.ai/catalog/standards/etsi/6d6420a9-35e2-4bb7-ba24-147465e91a86/etsi-en-302-842-1-v1-2-2-2010-12)

<https://standards.iteh.ai/catalog/standards/etsi/6d6420a9-35e2-4bb7-ba24-147465e91a86/etsi-en-302-842-1-v1-2-2-2010-12>