

ETSI TS 101 842 V1.1.1 (2007-05)

Technical Specification

**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
VHF air-ground Digital Link (VDL) Mode 4 radio equipment;
Technical characteristics and methods of measurement
for ground-based equipment;
VDL4 ground-based constituent requirement traceability
with the SES 552/2004 interoperability Regulation**



Reference

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document is accompanied by equivalent airborne standards, EN 302 842 [10] and TS 102 842 [11], covering the VHF air-ground Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for airborne equipment.

Introduction

The present document states the technical specifications for Very High Frequency (VHF) Digital Link (VDL) Mode 4 ground-based radio transmitters, transceivers and receivers for air-ground 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 VHF Digital Link (VDL) Standards and Recommended Practices (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 will be 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;
- equipment comply with EN 301 489-22 [5].

1 Scope

The present document applies to the following radio equipment types:

- Very High Frequency (VHF) Digital Link (VDL) Mode 4 ground-based radio transmitters and receivers for air-ground 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 VHF Digital Link (VDL) Standards and Recommended Practices (SARPs) [2].

The present document is designed to ensure that equipment will be compatible with the relevant ICAO VHF Digital Link (VDL) Standards and Recommended Practices (SARPs) [2] and VDL Mode 4 Technical Manual (TM) [1]. It also shows how the requirements can be traced to the ETSI interpretation of the EC 552/2004 [12] for the Single European Sky.

Manufacturers should note that in future the tuning range for the ground transceivers may also cover any 25 kHz channel from 108,000 MHz to 117,975 MHz.

The scope of the present document is limited to ground stations. The equivalent specification for airborne stations is EN 302 842 [10] and TS 102 842 [11].

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, air-to-ground, and ground-to-air services;
- operation without ground infrastructure.

The present document is derived from the specifications:

- VDL Mode 4 standards produced under the auspices of the International Civil Aviation Organization (ICAO) [1] and [2].
- 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 includes:

- clause 2 provides references to relevant documents;
- clause 3 provides general definitions, abbreviations and symbols used;
- clause 4 refers to a general description and architecture of VDL Mode 4 contained in EN 301 842-2 [7];
- clause 5 provides tables tracing technical requirements specifications applicable to the interoperability Regulation [12];
- annex A provides a Bibliography;
- a document history.

Mandating and Recommendation Phrases

- a) **"Shall"**
The use of the word "Shall" indicates a mandated criterion; i.e. 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

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version 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

- [1] ICAO Doc. 9816 - AN/448(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".
- [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] ETSI EN 301 489-22 (V1.3.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 22: Specific conditions for ground based VHF aeronautical mobile and fixed radio equipment".
- [6] ETSI EN 301 842-1 (V1.3.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF air-ground Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for ground-based equipment; Part 1: EN for ground equipment".
- [7] ETSI EN 301 842-2 (V1.5.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF air-ground Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for ground-based equipment; Part 2: General description and data link layer".
- [8] ETSI EN 301 842-3 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF air-ground Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for ground-based equipment; Part 3: Additional broadcast aspects".

- [9] ETSI EN 301 842-4 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF air-ground Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for ground-based equipment Part 4: Point-to-point functions".
- [10] ETSI EN 302 842 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF air-ground and air-air Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for aeronautical mobile (airborne) equipment".
- [11] ETSI TS 102 842 (all parts): Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF Air-ground and air-air Digital Link (VDL) Mode 4 radio equipment; Technical characteristics and methods of measurement for aeronautical mobile (airborne) equipment; VDL4 airborne constituent requirement traceability with the SES 552/2004 interoperability Regulation.
- [12] Regulation (EC) No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation).
- [13] Commission Regulation (EC) No 2150/2005 of 23 December 2005 laying down common rules for the flexible use of airspace.

3 Definitions and abbreviations

3.1 Definitions

3.1.1 Basic reference model definitions

The present document is based on the concepts developed in the open systems interconnect basic reference model and makes use of the following terms defined in ISO/IEC 7498-1 [3]:

- layer;
- sublayer;
- entity;
- service;
- service access point;
- service data unit;
- physical layer;
- data link layer.

3.1.2 Service conventions definitions

The present document makes use of the following terms defined in ISO/IEC 10731 [4]:

- service provider;
- service user;
- service primitive;
- request;
- indication;
- confirm.

3.1.3 General definitions

For the purposes of the present document, the terms and definitions given in EN 301 842-1 [6], EN 301 842-2 [7], and the following apply:

Automatic Dependent Surveillance-Broadcast (ADS-B): surveillance application transmitting parameters, such as position, track and ground speed, via a broadcast mode data link for use by any air and ground users requiring it

NOTE: ADS-B is a surveillance service based on aircraft self-determination of position/velocity/time and automatic, periodic or random, broadcast of this information along with auxiliary data such as aircraft identity (ID), communications control parameters, etc. ADS-B is intended to support multiple high-level applications and associated services such as cockpit display of traffic information, traffic alert and collision avoidance functionality, enhanced traffic management in the air and on the ground, search and rescue support and others.

current slot: slot in which a received transmission begins

Data Link Service (DLS) sublayer: sublayer that resides above the VDL Mode 4 Specific Services (VSS) and the MAC sublayers

NOTE: The data link service (DLS) manages the transmit queue, creates and destroys data link entities (DLEs) for connection-oriented communications, provides facilities for the link management entity (LME) to manage the DLS, and provides facilities for connection-less communications.

DLS system: VDL system that implements the DLS and subnetwork protocols to carry Aeronautical Telecommunications Network (ATN) or other packets

environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

equipment: constituent parts of the VDL Mode 4 system

ground base station: aeronautical station equipment, in the aeronautical mobile service, for use with an external antenna and intended for use at a fixed location

ground station co-ordination: co-ordination of transmissions from two or more ground stations using the UTC-minute time frame

link: connects a mobile DLE and a ground DLE and is uniquely specified by the combination of mobile DLS address and the ground DLS address

NOTE: A different subnetwork entity resides above every link endpoint.

link establishment: process by which two stations discover each other, determine to communicate with each other, decide upon the communication parameters, create a link and initialize its state before beginning communications

link layer: layer that lies immediately above the physical layer in the Open Systems Interconnection protocol model

NOTE: The link layer provides for the reliable transfer of information across the physical media. It is subdivided into the data link sublayer and the media access control sublayer.

Link Management Entity (LME): protocol state machine capable of acquiring, establishing, and maintaining a connection to a single peer system

NOTE: An LME establishes data link and subnetwork connections, "hands-off" those connections, and manages the media access control sublayer and physical layer. An aircraft LME tracks how well it can communicate with the ground stations of a single ground system. An aircraft VDL management entity (VME) instantiates an LME for each ground station that it monitors. Similarly, the ground VME instantiates an LME for each aircraft that it monitors. An LME is deleted when communication with the peer system is no longer viable.

Media Access Control (MAC): sublayer that acquires the data path and controls the movement of bits over the data path

mobile: radio equipment designed for installation into vehicles

physical layer: lowest level layer in the Open Systems Interconnection protocol model

NOTE: The physical layer is concerned with only the transmission of binary information over the physical medium (e.g. VHF radio).

primary time source: normal operation timing mode in which a VDL Mode 4 station maintains time synchronization to Universal Co-ordinated Time (UTC) second to within a two-sigma value of 400 ns

station: VDL Mode 4 Specific Services (VSS)-capable entity

NOTE: A station may be either a mobile station or a ground station. A station is a physical entity that transmits and receives bursts over the RF interface (either air-ground (A/G) or air-to-air (A/A)) and comprises, at a minimum: a physical layer, media access control sublayer, and a unique VSS address. A station which is also a DLS station has the same address.

subnetwork layer: layer that establishes, manages, and terminates connections across a subnetwork

synchronization burst (or "sync" burst): VDL Mode 4 burst which announces, as a minimum, existence and position

NOTE: Ground stations announce existence, position, and the current time. Mobile stations lacking timing information can then derive the slot structure from ground synchronization bursts. Mobile stations lacking position information can derive position from both mobile and ground synchronization bursts. This periodic information is used in various ways including ADS-B, secondary navigation, and simplifying the LME algorithms.

VDL Mode 4: VHF data link using a Gaussian Filtered Frequency Shift Keying modulation scheme and self-organizing time division multiple access

VDL Mode 4 Specific Services (VSS) sublayer: sublayer that resides above the MAC sublayer and provides VDL Mode 4 specific access protocols including reserved, random and fixed protocols

VDL Mode 4 station: physical entity that transmits and receives VDL Mode 4 bursts over the RF interface (either A/G or air-to-air (A/A)) and comprises, as a minimum: a physical layer, Media Access Control sublayer and a VSS sublayer

NOTE: A VDL Mode 4 station may either be a mobile VDL Mode 4 station or a ground VDL Mode 4 station.

VSS user: user of the VDL Mode 4 Specific Services

NOTE: The VSS user could be higher layers in the VDL Mode 4 Technical Manual or an external application using VDL Mode 4.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

A/A	Air-to-air
A/G	Air-to-Ground
ADS-B	Automatic Dependent Surveillance Broadcast
ANSP	Air Navigation Service Provider
ATN	Aeronautical Telecommunication Network
DLE	Data Link Entity
DLS	Data Link Service
FIS-B	Flight Information Service-Broadcast
GFSK	Gaussian-filtered Frequency Shift Keying
ICAO	International Civil Aviation Organization
ID	IDentity
ISO	International Organization for Standardization
LME	Link Management Entity
MAC	Media Access Control
OSI	Open Systems Interconnection
R&TTE	Radio equipment and Telecommunications Terminal Equipment
SARP	Standards and Recommended Practices
TIS-B	Traffic Information Service-Broadcast
VDL	VHF Digital Link

VDL4	VDL Mode 4
VHF	Very High Frequency
VME	VDL Management Entity
VSS	VDL Mode 4 Specific Services

4 General description and architecture of VDL Mode 4

4.1 General

A description of VDL Mode 4, the communication services provided, the equipment classes, the structure of the standards material and guidance on equipment performance verification is provided in EN 301 842-2 [7], clause 4.

In most respects, the VDL Mode 4 ground station follows the provisions of the ICAO standards material for VDL Mode 4. Within the ICAO standard, there are some requirements that apply explicitly only to airborne stations. These are addressed in the accompanying document EN 302 842 [10].

A number of other requirements will also not apply because of the assumed services provided by the ground station.

4.2 Coverage of the interoperability Regulation

Table 4.1: Coverage of the interoperability Regulation

This table indicates which of the essential requirements in Annex II of the interoperability Regulation [12] are considered in the present document.

Essential requirements Part A: General requirements				
No.	Title	Constituent level	System level	Explanation
A1	Seamless operation	Part covered	N/A	System requirements are not covered. Requirements relating to maintenance and operation are not relevant.
A2	Support for new concepts of operation	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
A3	Safety	Part covered	N/A	System requirements are not covered. Requirements relating to maintenance and operation are not relevant.
A4	Civil-military coordination	Part covered	N/A	Airspace management, air traffic flow management and national security requirements are not relevant at the constituent level.
A5	Environmental constraints	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
A6	Principles governing the logical architecture of systems	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
A7	Principles governing the construction of systems	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
Essential requirements Part B: Specific requirements				
B1	Systems and procedures for airspace management	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
B2	Systems and procedures for air traffic flow management	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
B3	Systems and procedures for air traffic services	Part covered	N/A	System requirements are not covered. Only the design and build requirements for ground-based constituents are covered.
B4	Communications systems and procedures for ground-to-ground, air-to-ground and air-to-air communications	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
B5	Navigation systems and procedures	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
B6	Surveillance systems and procedures	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.
B7	Systems and procedures for aeronautical information services	Covered	N/A	Provision of information and the standards governing its format and content are relevant for constituents.
B8	Systems and procedures for the use of meteorological information	N/A	N/A	This requirement can only be applied to systems and is not relevant at the constituent level.

4.3 Scope of interoperability

It is only possible to trace the constituent parts of the VDL Mode 4 ground-based equipment with the interoperability Regulation. System-level configurations are outside the scope of the present document, as they are not manufacturer-specific.

The scope of the present document is illustrated by the figure 4.1.

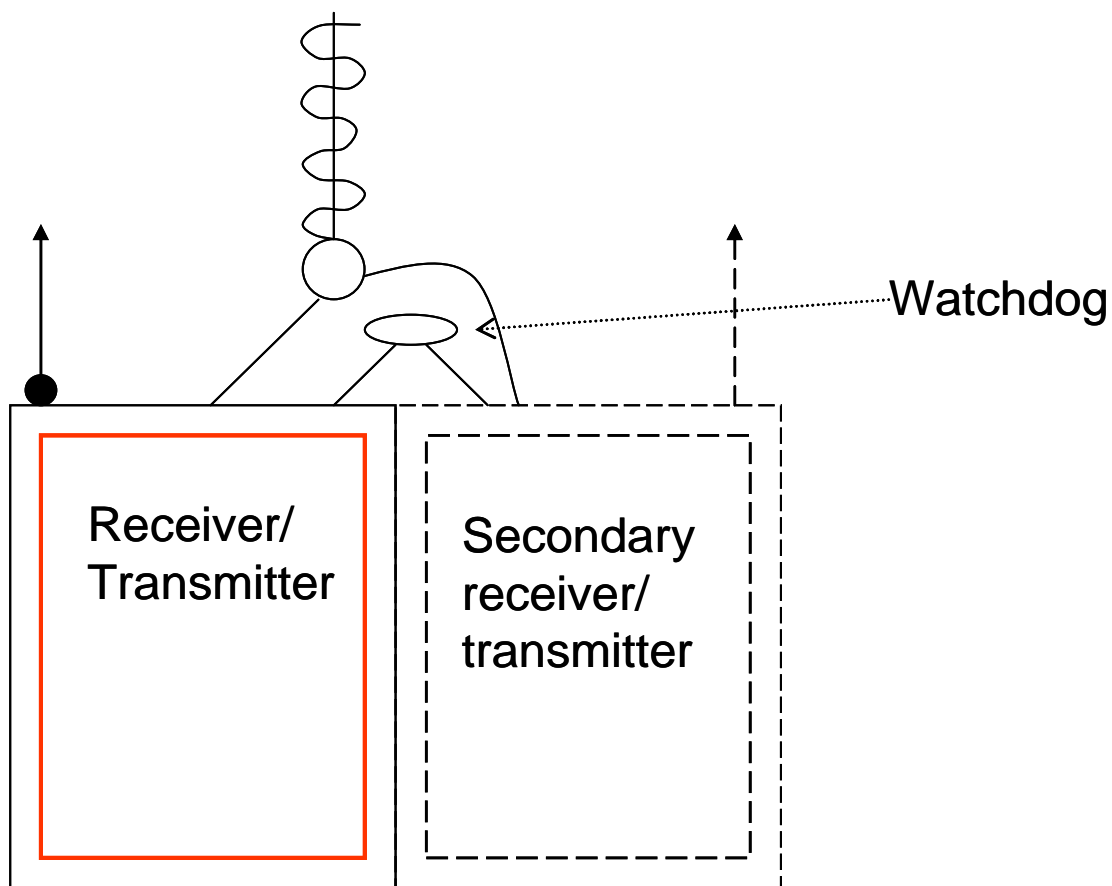


Figure 4.1: Ground-based equipment

5 Traceability to interoperability Essential Requirements

5.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the supplier. The equipment shall comply with all of the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

5.2 Requirement traceability

EC 552/2004 [12] has been examined by ETSI, and the tables below refer to the agreed interpretation.

NOTE: The requirements contained in Annex II of the interoperability Regulation were examined by TG25 of ETSI and were interpreted, by consensus, into meaningful statements relevant to the VDL Mode 4 equipment.

Table 5.1 outlines the mapping between the VDL Mode 4 ground station equipment essential requirements (taken from EN 301 842 parts 1, 2, 3 and 4) and the related interpretation of each of the interoperability Regulation requirements in EC 552/2004 [12].

Table 5.2 cross-references the EC 552/2004 [12] requirement interpretations to the EN 301 842 requirements.

Table 5.1: VDL Mode 4 requirement traceability to EC 552/2004

Requirement reference	Title	EC 552/2004 requirements	Description of traceability
EN 301 842-1 requirements			
5	VDL Mode 4 physical layer functional specifications	A1	Physical layer specification
5.1	Overview		Seamless operation with availability of function
5.1.1	Functions		Synchronized communication to accepted standards
5.1.2	Data reception		Communication processing
5.1.3	Data transmission		Communication processing
5.2	Modulation scheme		Communication processing
6	VDL Mode 4 equipment requirements	A1, B7.1, B7.2	Systems operated with validated procedures
6.2.7	Conducted Spurious emissions		Minimizing environmental impact
7	General design requirements	A1, A3	Design requirements
7.1	Controls and indicators		See note 1a
7.2	Class of emission and modulation characteristics		High consistency
7.3	Warm up		High consistency
EN 301 842-2 requirements			
4	General description of VDL Mode 4 ground station link layer	A3, B3.1.2, B7.1, B7.2	Support for new concepts of operation
4.1.1	Overview of VDL Mode 4	A1, A4	Seamless communication enabled coherently
4.1.2	Relationship to OSI reference model	A1	Established standard used
4.1.3	VDL Mode 4 services		Real-time data sharing over a secure medium
4.1.4	ADS-B Function	A1	ADS-B gives constant data sharing for flight information and surveillance
4.1.5	Operational scenarios		Communications systems
4.1.6	VDL Mode 4 fundamentals	A1	Common defined surveillance information structure for FDP
4.1.7	Possible configuration of ground equipment	A3, B3.1.2	Configurations meet ICAO standards
4.1.8	Overall structure of specifications for VDL Mode 4	B3.1.2	Sound logical structure specifications
4.1.9	Equipment performance verification	A1, B3.1.2	Performance specification
4.2	Ground quarantine		See note 1a
4.3	System timing		Timely information sharing
4.4	Net entry		See note 1a
4.5	Autotune capability		Coherent information sharing
4.6	Autonomous and fixed access		See note 1a
5.1	MAC sublayer		See note 1a
5.1.4	Time synchronization		Timely information sharing
5.1.5	Slot idle/busy notification		Coherent information sharing
5.1.6	Transmission processing		See note 1a
5.1.7	Received transmission processing		See note 1a
5.2	VSS sublayer	B7.1	Communication integrity and continuity to appropriate procedures
5.3	DLS sublayer		Communication integrity and continuity to appropriate procedures
5.4	Link Management Entity sublayer		Timely information sharing

Requirement reference	Title	EC 552/2004 requirements	Description of traceability
5.5	Additional requirements for ground stations		Co-ordinated information sharing
5.5.1	System timing requirements		See note 1
5.5.1.1	Maintenance of Primary time		See note 1
5.5.1.1.1	—		Timely information sharing
5.5.2	Ground station interface requirements		See note 1
5.5.2.1	Ground station co-ordination		Co-ordinated information sharing
5.5.2.1.1	—		Co-ordinated operating structure
5.5.2.2	Network timing requirements		Timely information sharing
5.5.2.3	Application interface requirements		Sharing of flight information
5.5.2.4	Transmission control requirements		See note 1a
5.5.2.5	Superframe block reservation rebroadcast procedures		Coherent information sharing
5.5.2.6	Fixed transmission parameters		See note 2
5.5.2.7	Protection of fixed access protocol transmissions by ground quarantine		See note 2
5.5.2.8	Protection of fixed access protocol transmissions by use of appropriate reservation protocols		See note 2
5.5.2.9	Restriction of autotune reservations		See note 2
5.5.2.10	Transmission time for autotune reservations		See note 2
5.5.2.11	Reporting of channel usage		Availability of function for communications
5.6	Definitions For Compact Position Reporting		Accurate and reliable surveillance data
6	General design requirements	A1	
6.1	Controls and indicators		See note 1a
6.2	Operation of controls	A3	Reliable HMI facility
6.3	Warm up		Reliable HMI facility
6.4	Effects of tests		See note 1a
6.5	Software management	A3	Safety standards
6.6.1	Failure of the VDL equipment	A3	Seamless operation with high safety standards
6.7	Monitoring of proper operation		Communications and surveillance systems integrity
EN 301 842-3 requirements			
4	General description of VDL Mode 4 ground station link layer		See note 1
4.1	General	B7.1, B7.2	Timely systems to support data sharing
4.2	Automatic Dependent Surveillance – Broadcast		Surveillance systems
4.3	Traffic Information Service – Broadcast		Surveillance systems, aeronautical information
4.4	Flight Information Service – Broadcast		Meteorological information
4.5	GNSS Augmentation Service – Broadcast (GNS-B)		Airspace management, surveillance systems
4.6	Ground Station Co-ordination	A1	Seamless operation, timely data sharing
5	Minimum performance specification under standard test conditions	B7.1, B7.2	General operational requirements
5.1	Requirements for ADS-B		Coherent surveillance data sharing to agreed standards
5.1.3	Default ADS-B Reporting		Timely information sharing
5.2	Requirements for TIS-B		See note 1
5.2.1	Traffic Information Volume		Air traffic management services for aeronautical information
5.2.2	Message transmission		Air traffic management
5.2.3	Message format		Consistent surveillance data

Requirement reference	Title	EC 552/2004 requirements	Description of traceability
5.2.4	Management message		See note 1a
5.2.5	Aircraft target messages (airborne TIV)		See note 1a
5.2.6	Aircraft target messages (ground TIV)		See note 1a
5.2.7	Ground vehicle target messages (ground TIV)		See note 1a
5.2.8	TIS-B offset encoding		See note 1a
5.3	Requirements for FIS-B		Meteorological information
5.4	Requirements for GNSS Augmentation Service Broadcast (GNS-B) message		See note 2
6	General design requirements		See note 1
EN 301 842-4 requirements			
4	General description of VDL Mode 4 ground station point-to-point services		See note 1
4.1	General	B7.1, B7.2	Timely systems to support data sharing
4.2	Data Link Service (DLS) and Link Management Entity (LME)		See note 1
4.2.1	General		Protocol used for integrity of communication, support for future protocols
4.3	Additional VSS services		Protocol used for integrity of communication
5	Minimum performance specification under standard test conditions		See note 1
5.1	DLS sublayer		Communication standard and protocol
5.2	Link management entity sublayer		Communication standard and protocol
5.3	Additional VSS requirements		Communication standard and protocol
6	General design requirements		See note 1
<p>In this table:</p> <ul style="list-style-type: none"> • column 1 is a reference to the requirement in the present document; • column 2 identifies clause titles taken from the present document; • column 3 is a reference to a section in Annex II of the EC 552/2004 [12]; • column 4 describes how the traceability is shown. 			
NOTE 1: The clause number in column 1 is a headline or an introduction to requirements that are detailed in subsequent clauses.			
NOTE 1a: The clause number in column 1 is a definition. It may not be possible to demonstrate specific requirement traceability.			
NOTE 2: Only essential requirements are traced. Detailed requirements are not traced.			

Table 5.2: VDL Mode 4 requirement traceability to EC 552/2004

EC 552/2004 Reqt.	EC 552/2004 Requirement Title	Interpretation of EC 552/2004 Requirement text	EN 301 842 Requirements traceable to EC 552/2004 requirement	EN 301 842 Requirement Title	Description of traceability
A1	General requirements: Seamless operation	The ANSPs shall demonstrate their strategies and plans to improve seamless operations within their airspace and in interacting with other ANSPs (including airports), with the objective to harmonize. In the future this should be aligned with the concept of operation (SESAR).	EN 301 842-1: 5	VDL mode 4 physical layer functional specifications	Specifies equipment characteristics for seamless operation
			EN 301 842-1: 6	VDL Mode 4 equipment requirements	Specifies equipment performance for seamless operation
			EN 301 842-1: 7	General design requirements	Specifies equipment performance for seamless operation
			EN 301 842-2: 4.1.1	Overview of VDL Mode 4	VDL4 allows constant seamless air/ground communication
			EN 301 842-2: 4.1.2	Relationship to OSI reference model	Constituent boundaries
			EN 301 842-2: 4.1.4	ADS-B Function	ADS-B allows constant information sharing to a common standard
			EN 301 842-2: 4.1.6	VDL Mode 4 fundamentals	VDL4 operation allows seamless sharing of data through its flexible message structure
			EN 301 842-2: 4.1.9	Equipment performance verification	Verification of equipment performance to required standards
			EN 301 842-2: 6	General design requirements	Equipment characteristics are specified
			EN 301 842-3: 4.6	Ground Station Co-ordination	Ground station requirements mean effective information sharing
A3	General requirements: Safety	The ANSPs shall demonstrate the safety management and reporting methodologies which are used. Each ANSP should provide evidence to support the rationale of the chosen hazard matrix. The ANSPs should demonstrate that the safety assurance activities and safety net performance parameters are adequate and appropriate.	EN 301 842-1: 7	General design requirements	Specifies equipment performance for seamless operation
			EN 301 842-2: 4	General description of VDL Mode 4 ground station link layer	VDL4 allows Airborne Situation Awareness, Improved Controllers Situation Awareness, Runway Incursion Prevention, Reliable MTCD, Conflict Detection and Resolution, Improved STCA
			EN 301 842-2: 4.1.7	Possible configuration of ground equipment	High levels of safety provided by testing and by dual installation
			EN 301 842-2: 6.2	Operation of controls	Safety standards minimizing harmful interference
			EN 301 842-2: 6.5	Software management	Development follows an approved management system
			EN 301 842-2: 6.6.1	Failure of the VDL equipment	High safety shown by continuous power supply and ground station redundancy

EC 552/2004 Reqt.	EC 552/ 2004 Requirement Title	Interpretation of EC 552/2004 Requirement text	EN 301 842 Requirements traceable to EC 552/2004 requirement	EN 301 842 Requirement Title	Description of traceability
A4	General requirements: Civil-military coordination	Regulation EC 2150/2005 [13] shall be fulfilled by the ANSPs.	EN 301 842-2: 4.1.1	Overview of VDL Mode 4	Military use improves co-ordination and flexible use of airspace
B3.1.2	Specific requirements: Systems and procedures for air traffic services: Flight data processing systems: Support for new concepts of operation	Ground system constituents supporting new, agreed and validated concepts of operation shall be designed and built, using appropriate and validated procedures, in such a way as to be interoperable in terms of timely sharing of correct and consistent information and a common understanding of the current and predicted operational situation.	EN 301 842-2: 4	General description of VDL Mode 4 ground station link layer	VDL4 structure allows seamless flight information sharing to make flight data processing systems interoperable
B7.1	Specific requirements: Systems and procedures for aeronautical information services: Seamless operation	The ANSPs shall demonstrate their strategies and plans to seamlessly provide accurate and consistent aeronautical information, in an electronic form when appropriate, in a timely manner, with the objective to harmonize. The ANSPs shall ensure that they have a common agreement of the standardized data set which may be used as a basis for aeronautical information provision. In the future this should be aligned with the concept of operation (SESAR).	EN 301 842-1: 6	VDL Mode 4 equipment requirements	Agreed and validated equipment requirements meet the operational concept for aeronautical information services
			EN 301 842-2: 4	General description of VDL Mode 4 ground station link layer	VDL4 supports increasingly accurate, timely and complete aeronautical information sharing
			EN 301 842-2: 5.2	VSS sublayer.	VSS sublayer requirements give an appropriate transmission format for aeronautical information
			EN 301 842-3: 4.1	General	VDL4 link layer supports accurate, timely sharing of aeronautical information
			EN 301 842-3: 5	Minimum performance specification under standard test conditions	Requirements for consistent VDL4 operation
			EN 301 842-4: 4.1	General	Point-to-point requirements support aeronautical information sharing with all interested parties

EC 552/2004 Reqt.	EC 552/2004 Requirement Title	Interpretation of EC 552/2004 Requirement text	EN 301 842 Requirements traceable to EC 552/2004 requirement	EN 301 842 Requirement Title	Description of traceability
B7.2	Specific requirements: Systems and procedures for aeronautical information services: Support for new concepts of operation	Each ANSP shall demonstrate its strategies and plans for the improvement of the accuracy and completeness of the aeronautical information being made available, and the timely use of this information, to support the continuous improvement of the efficiency of airspace and airport use. In the future this should be aligned with the concept of operation (SESAR).	EN 301 842-1: 6	VDL Mode 4 equipment requirements	Agreed, validated equipment requirements support new concepts of operation for aeronautical information sharing
			EN 301 842-2: 4	General description of VDL Mode 4 ground station link layer	VDL Mode 4 support increasingly accurate, timely and complete aeronautical information sharing
			EN 301 842-3: 4.1	General	VDL Mode 4 link layer requirements support accurate and timely sharing of aeronautical information and support new concepts of operations
			EN 301 842-3: 5	Minimum performance specification under standard test conditions	Requirements for consistent VDL4 operation
			EN 301 842-4: 4.1	General	Point-to-point requirements support aeronautical information sharing with all interested parties
<p>In this table:</p> <ul style="list-style-type: none"> • column 1 is a reference to a section in Annex II of the EC 552/2004 [12]; • column 2 identifies clause titles taken from Annex II of the EC 552/2004 [12]; • column 3 is the agreed ETSI interpretation of the requirement referred to in column 1; • column 4 identifies a requirement number from the present document; • column 5 identifies clause titles taken from the present document; • column 6 describes how the traceability is shown. 					
NOTE 1: The clause number in column 4 is a headline or an introduction to requirements that are detailed in subsequent clauses.					
NOTE 1a: The clause number in column 4 is a definition. It may not be possible to demonstrate specific requirement traceability.					
NOTE 2: Only essential requirements are traced. Detailed requirements are not traced.					

Annex A (informative): Bibliography

- EUROCAE ED-78A: "Guidelines for approval of the provision and use of ATS supported by data communications".
- EUROCAE ED-108A: "MOPS for the Very High Frequency (VHF) Digital Link (VDL) Mode 4 Aircraft Transceiver".
- ETSI TR 102 579: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Report on the development of harmonized standards under the Single European Sky (SES) interoperability (IOP) regulation 552/2004 (Community Specifications)".

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History

Document history		
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