

**Satellite Earth Stations and Systems (SES);
Harmonized EN for Vehicle-Mounted Earth Stations (VMES)
operating in the 14/12 GHz frequency bands
covering the essential requirements
of article 3.2 of the R&TTE directive**

iTeh STANDARD PREVIEW
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sist/9719022b-4a9e-4278-8f5c-2a00dcd4da43/etsi-en-302-977-v1.1.2-2010-02>



Reference

DEN/SES-00301

Keywords

antenna, earth station, GSO, regulation, satellite

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

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 2009.
All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™**, **TIPHON™**, the TIPHON logo and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.

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

LTE™ 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	6
1 Scope	7
2 References	8
2.1 Normative references	8
2.2 Informative references.....	9
3 Definitions, symbols and abbreviations	9
3.1 Definitions	9
3.2 Symbols.....	12
3.3 Abbreviations	12
4 Technical requirements specifications	13
4.1 General	13
4.1.1 Environmental profile	13
4.1.2 Operational configurations	13
4.1.3 Determination of geographic location of the VMES	14
4.1.4 VMES states and radio states.....	14
4.2 Conformance requirements	15
4.2.1 Off-axis spurious radiation	15
4.2.1.1 Justification	15
4.2.1.2 Specification.....	15
4.2.1.3 Conformance tests.....	16
4.2.2 On-axis spurious radiation for VMES	16
4.2.2.1 Justification	16
4.2.2.2 Specification.....	16
4.2.2.2.1 "Carrier-on" radio state.....	16
4.2.2.2.2 "Carrier-off" and "Emissions-disabled" radio states.....	17
4.2.2.3 Conformance tests.....	17
4.2.3 Off-axis e.i.r.p. emission density within the band.....	17
4.2.3.1 Justification	17
4.2.3.2 Specification.....	17
4.2.3.3 Conformance tests.....	19
4.2.4 Carrier suppression	19
4.2.4.1 Justification	19
4.2.4.2 Specification.....	19
4.2.4.3 Conformance tests.....	19
4.2.5 Antenna pointing and polarization alignment for VMESs.....	19
4.2.5.1 Justification	19
4.2.5.2 Specification.....	19
4.2.5.3 Conformance tests.....	20
4.2.6 Cessation of emissions of the VMES.....	21
4.2.6.1 Justification	21
4.2.6.2 Specification.....	21
4.2.6.2.1 Specification 1: Mode of cessation of emissions.....	21
4.2.6.2.2 Specification 2: Conditions under which the VMES must cease emissions.....	21
4.2.6.2.3 Specification 3: Cessation of emissions	22
4.2.6.2.4 Specification 4: Fault conditions	22
4.2.6.3 Conformance tests.....	22
4.2.7 Identification of the VMES.....	22
4.2.7.1 Justification	22
4.2.7.2 Specification.....	22
4.2.7.3 Conformance tests.....	22
4.2.8 Control and Monitoring Functions (CMFs).....	23

4.2.8.1	CMF state diagram	23
4.2.8.2	Processor monitoring	24
4.2.8.2.1	Justification	24
4.2.8.2.2	Specification	24
4.2.8.2.3	Conformance tests	24
4.2.8.3	Transmit subsystem monitoring	24
4.2.8.3.1	Justification	24
4.2.8.3.2	Specification	24
4.2.8.3.3	Conformance tests	24
4.2.8.4	Power-on/Reset	24
4.2.8.4.1	Justification	24
4.2.8.4.2	Specification	24
4.2.8.4.3	Conformance tests	25
4.2.8.5	Control Channel (CC) and Response Channel (RC)	25
4.2.8.5.1	Justification	25
4.2.8.5.2	Specification	25
4.2.8.5.3	Conformance tests	26
4.2.8.6	Network control commands	26
4.2.8.6.1	Justification	26
4.2.8.6.2	Specification	26
4.2.8.6.3	Conformance tests	26
4.2.8.7	Initial burst transmission	26
4.2.8.7.1	Justification	26
4.2.8.7.2	Specification	26
4.2.8.7.3	Conformance tests	27
4.2.8.8	Inhibition of transmissions	27
4.2.8.8.1	Justification	27
4.2.8.8.2	Specification	27
4.2.8.8.3	Conformance tests	27
5	Testing for compliance with technical requirements	27
5.1	Environmental conditions for testing	27
5.2	Essential radio test suites	27
6	Test methods for all aspects of the VMES	28
6.1	General	28
6.2	Off-axis spurious radiation	28
6.2.1	Test method	29
6.3	On-axis spurious radiation	29
6.3.1	Test method	29
6.4	Off-axis e.i.r.p. emission density within the band	29
6.4.1	Test method	29
6.4.1.1	General	29
6.4.1.2	Transmit output power density	30
6.4.1.3	Antenna transmit gain	30
6.4.1.4	Antenna transmit radiation patterns	30
6.4.2	Computation of results	30
6.5	Carrier suppression	31
6.5.1	Test method	31
6.6	Antenna pointing for VMES	31
6.6.1	General	31
6.6.2	Test method	31
6.7	Antenna mechanical stability	31
6.7.1	Test method	31
6.8	Polarization angle alignment capability	31
6.8.1	Test method	32
6.9	Cessation of emissions of the VMES	32
6.9.1	Test Method	32
6.9.1.1	Required documentation	32
6.9.1.2	Cessation of emissions from the "Transmission-enabled" state	32
6.9.1.3	Cessation of emission from the "Transmission-disabled" state	33
6.9.1.4	Cessation of emission from the "Initial Phase" state	33

6.9.1.4.1	EUTs transmitting initial bursts.....	33
6.9.1.4.2	EUTs not transmitting initial bursts.....	33
6.9.1.5	"Single action" means of cessation of emissions.....	34
6.9.1.6	Fault conditions.....	34
6.10	Identification of VMES.....	35
6.10.1	Test arrangement.....	35
6.10.2	Test method.....	35
6.11	Control and monitoring functions.....	35
6.11.1	Test arrangement.....	35
6.11.2	Processor monitoring- Test method.....	35
6.11.3	Transmit subsystem monitoring-Test method.....	35
6.11.4	Power-on/Reset-Test method.....	36
6.11.5	Control Channel and Response Channel -Test method.....	36
6.11.6	Network Control commands-Test method.....	37
6.11.7	Initial burst transmission-Test method.....	38
6.11.8	Inhibition of transmission-Test method.....	38
Annex A (normative):	HS Requirements and conformance Test specifications Table (HS-RTT).....	40
Annex B (informative):	Mechanical stability methodology.....	42
Annex C (informative):	Typical Scan and Acceleration Rates.....	44
Annex D (informative):	The EN title in the official languages.....	45
Annex E (informative):	Bibliography.....	46
History.....		47

iTeh STANDARD PREVIEW
 (standards.iteh.ai)
 Full standard:
<https://standards.iteh.ai/catalog/standards/sist/9779022b4a9e4278-8f5c-2a00dcd4da43/etsi-en-302-977-v1.1.2-2010-02>

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 Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES), and is now submitted for the Vote phase of the ETSI standards Two-step Approval Procedure.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Directive 98/34/EC [i.1] (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Directive 1999/5/EC [1] of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

Technical specifications relevant to Directive 1999/5/EC [1] are given in annex A.

Proposed national transposition dates

Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive [1]. The modular structure is shown in EG 201 399 [i.2].

1 Scope

The present document applies to Earth Stations located on board Vehicles, which have the following characteristics.

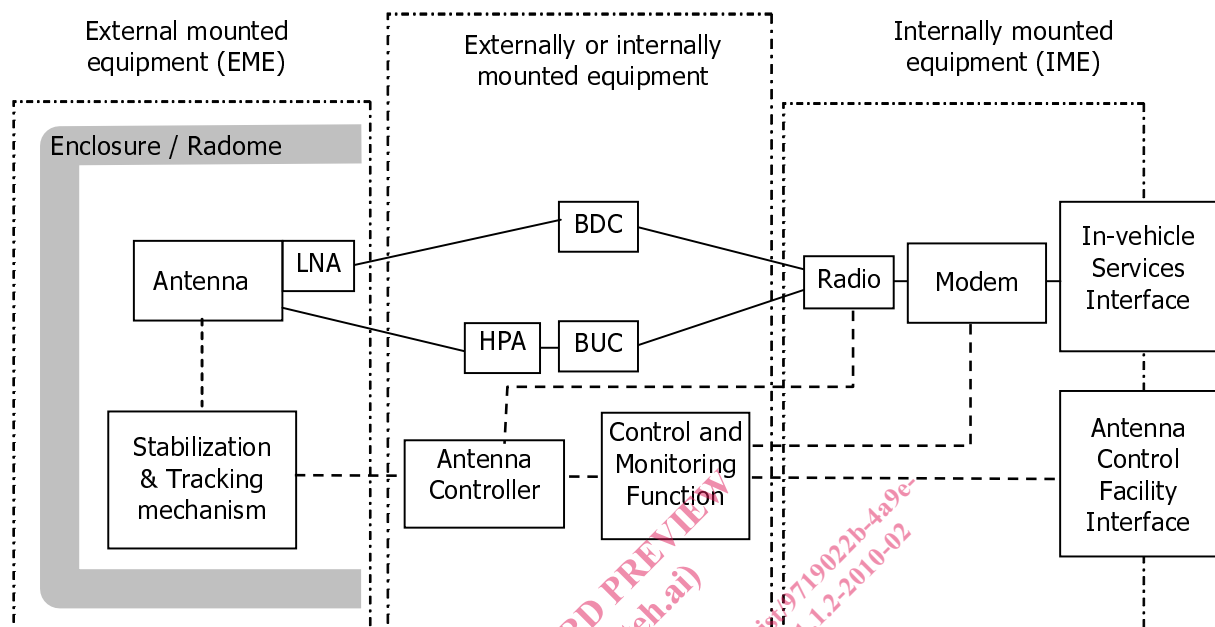


Figure 1: VMES System Overview

- The VMES may transmit and receive data when the vehicle is in motion and also when the vehicle is stationary.
- The VMES operates on wheeled or tracked vehicles and, therefore, may be subject to occasional disturbances and interruptions in the satellite link.
- The VMES is operating as part of a satellite network (e.g. star, mesh or point-to-point) used for the distribution and/or exchange of information.
- The VMES is comprised of all the equipment, electrical and mechanical, from the antenna itself to the interface with other communications equipment on a vehicle (usually referred to as the terrestrial interface).
- The VMES transmits on single carrier in the frequency range 14,00 GHz to 14,50 GHz, which is a band allocated to the Fixed Satellite Services (FSS) (Earth-to-space) among other services. However, operation of the VMES is intended to be restricted to the lower half of the band in and near those countries that have allocated Fixed Service (FS) to the upper half. Local regulation may permit operation in the upper half of the band.

NOTE 1: For the purposes of the present specification, OFDM modulation is considered as a single carrier.

- The VMES receives in one or more frequencies within the range from 10,70 GHz to 12,75 GHz in bands allocated to the Fixed Satellite Services (FSS) (space-to-Earth) or the Broadcast Satellite Service (BSS) (space-to-Earth), depending on the ITU Region where the VMES is located.
- The VMES uses linear or circular polarization.
- The VMES is designed to operate through a geostationary satellite (or a cluster of co-located geostationary satellites) that is at least 3° away from any other geostationary satellite operating in the same frequencies and over the same coverage area.

NOTE 2: Satellites may be spaced closer than 3° . In such cases, the satellite operator will inform the VMES client of the requirements of the system coordination agreements.

- The VMES transmits at elevations greater than or equal to 7 ° relative to the local horizon.
- The VMES is designed for unattended operation.
- The VMES is designed for both mobile and stationary operation. In the case of stationary operation, the VMES must not be accessible to the general public and operated safely.
- The VMES is controlled and monitored by an Antenna Control Facility (ACF). This function may be performed centrally (e.g. for a network of VMESs with a central hub) or it could be performed within the VMES for autonomous control. The ACF is outside the scope of the present document.

The present document applies to the VMES with its ancillary equipment and its various telecommunication ports, and when operated within the boundary limits of the operational environmental profile as declared by the applicant and when installed as required by the applicant's declaration or in the user documentation.

The present document is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive) article 3.2, which states that "... radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

NOTE 3: Operational requirements are defined by national administrations and by relevant ECC Decisions.

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the Directive 1999/5/EC [1] (R&TTE Directive) may apply to equipment within the scope of the present document.

NOTE 4: A list of such ENs is included on the web site <http://www.newapproach.org/>.

2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

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.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [2] CISPR 16-1-1 Ed. 2.2 (2007): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".

- [3] CISPR 16-1-5 (2003): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1-5: Radio disturbance and immunity measuring apparatus - Antenna calibration test sites for 30 MHz to 1 000 MHz".
- [4] CENELEC EN 60529 (1991): "Degrees of protection provided by enclosures (IP code)".
- [5] CENELEC EN 60068-2-6 (2008): "Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)".
- [6] CENELEC EN 60068-2-11 (1999): "Environmental testing - Part 2-11: Tests - Test Ka: Salt mist".
- [7] CENELEC EN 60068-2-27 (2007): "Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock".
- [8] MIL STD 810F (2000): "DOD Test Method Standard for Environmental Engineering Considerations and Laboratory Tests".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- [i.2] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".
- [i.3] ETSI TR 102 375: "Satellite Earth Stations and Systems (SES); Guidelines for determining the parts of satellite earth station antenna radiation patterns concerned by the geostationary satellite orbit protection".
- [i.4] ETSI TR 102 215: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Recommended approach, and possible limits for measurement uncertainty for the measurement of radiated electromagnetic fields above 1 GHz".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 1999/5/EC [1] and the following apply:

ancillary equipment: equipment used in connection with a VMES is considered as ancillary if the three following conditions are met:

- the equipment is intended for use in conjunction with the VMES to provide additional operational and/or control features (e.g. to extend control to another position or location); and
- the equipment cannot be used on a stand alone basis, to provide user functions independently of the VMES; and
- the absence of the equipment does not inhibit the operation of the VMES.

Antenna Control Facility (ACF): set of functional entities that, at system level, monitor and control the correct operation of the VMES and, if appropriate, all of the VMESs in a network

antenna controller: equipment used to maintain antenna stabilization and tracking accuracy based on inputs from the Control and Monitoring Function

applicant: manufacturer or his authorized representative within the European Community or the person responsible for placing the apparatus on the market

carrier-off radio state: radio state in which the VMES may transmit and does not transmit any carrier

NOTE 1: The phrase "the VMES may transmit" means that all the conditions for transmission are satisfied (e.g. in a state where transmissions are permitted, no failure detected, and the VMES is correctly pointed towards the satellite).

NOTE 2: The existence of a "Carrier-off" radio state depends on the system of transmission used. For VMESs designed for continuous transmission mode there may be no "Carrier-off" state.

carrier-on radio state: radio state in which the VMES may transmit and transmits a carrier

Control Channel (CC): channel or channels by which VMESs receive control information from the ACF

EIRP_{max}: maximum e.i.r.p. capability of the VMES as declared by the applicant

emissions-disabled radio state: radio state in which the VMES must not emit

NOTE: Examples of cases where the VMES is in this radio state: before system monitoring pass, before the control channel is received, when a failure is detected, when a VMES is commanded to disable, and when the VMES is in a location requiring cessation of emissions.

external control channel: control channel which is either:

- (i) carried by the VMES network via the same or another satellite, but not within the internal protocol of the VMES system; or
- (ii) carried by any other radio communication system.

Externally Mounted Equipment (EME): that part of the VMES intended to be installed on the outside of the vehicle (usually the roof), as declared by the applicant, or as indicated in the user documentation

NOTE 1: The EME unit is usually comprised of the following main parts:

- a) The antenna sub-system which converts the incident radiation field into a guided wave and vice versa.
- b) The Low Noise Amplifier (LNA) which is a device that amplifies, with very low internal noise, the received signals in the Radio Frequency (RF) band.
- c) The stabilization and tracking mechanics that ensure pointing of the antenna main beam towards the satellite within the required accuracy.
- d) The radome for protecting the antenna subsystem, if required for normal operation.

NOTE 2: The LNA could be replaced by an LNB, which includes the block down converter. Optionally, the EME may include the following elements (otherwise they will be part of the IME):

- a) A Block Up Converter (BUC) and High Power Amplifier (HPA) which convert from the intermediate frequency to RF and amplify the low level RF signals for transmission through the antenna subsystem.
- b) The Antenna Controller Processor.
- c) The Control and Monitoring Function.

NOTE 3: The installation equipment (means of attachment) is outside the scope of the present document. However, the antenna structures and other components directly mounted on the antenna and forming an integral part of it, are subject to the specifications of the present document.

NOTE 4: Certain configurations may include more than one EME per VMES. As for example, the VMES may have separate transmit and receive antennas or it may have redundant transmit/receive antenna units.

external response channel: response channel which is either:

- (i) carried by the VMES network via the same or another satellite, but not within the internal protocol of the VMES system; or
- (ii) carried by any other radio communication system.

integral antenna: antenna which may not be removed during the tests according to the applicant's statement

internal control channel: control channel which is carried by the VMES network via the same satellite as used for transmission of user data and within the internal protocol structure of the VMES system

Internally Mounted Equipment (IME): part of the VMES equipment which is installed inside the vehicle and its connection cables with the EME

NOTE: The IME is usually comprised of:

- a) the modem and the IF radio equipment;
- b) the interfaces to equipment and services onboard the vehicle.

Optionally the IME may include the following elements (otherwise they will be included in the EME):

- c) a Block Down Converter (BDC), which converts the RF signals to intermediate frequencies;
- d) a Block Up Converter (BUC) and High Power Amplifier (HPA) which convert from the intermediate frequency to RF and amplify the low level RF signals for transmission through the antenna subsystem;
- e) the Antenna Controller Processor;
- f) the Control and Monitoring Functions.

internal response channel: response channel which is carried by the VMES network via the same satellite as used for transmission of user data and within the internal protocol structure of the VMES system

maximum relative wind speed: addition of the magnitudes of the maximum wind speed and the maximum vehicle velocity

nominated bandwidth: bandwidth of the VMES radio frequency transmission nominated by the applicant

NOTE 1: The nominated bandwidth is centred on the transmit frequency and does not exceed 5 times the occupied bandwidth.

NOTE 2: The nominated bandwidth is wide enough to encompass all spectral elements of the transmission which have a level greater than the specified spurious radiation limits. The nominated bandwidth is wide enough to take account of the transmit carrier frequency stability. This definition is chosen to allow flexibility regarding adjacent channel interference levels which will be taken into account by operational procedures depending on the exact transponder carrier assignment situation.

occupied Bandwidth (Bo):

- for a digital modulation scheme: the width of the signal spectrum 10 dB below the maximum in-band density;
- for an analogue modulation scheme: the width of a frequency band such that, below the lower and above the upper frequency limits, the mean power emitted is equal to 0,5 % of the total mean power of the emission.

off-axis angle: angle between the direction of the axis of the antenna main beam and the considered direction

removable antenna: antenna which may be removed during the tests according to the applicant's statement

Response Channel (RC): channel by which VMES transmit monitoring information to the ACF

spurious radiation: any radiation outside the nominated bandwidth

transmission-disabled state: VMES is in this state when it is not authorized by the ACF to transmit

transmission-enabled state: VMES is in this state when it is authorized by the ACF to transmit

3.2 Symbols

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

dBc	ratio expressed in decibels relative to the e.i.r.p. of the unmodulated carrier
dBi	ratio of an antenna gain to the gain of an isotropic antenna, expressed in decibels
dBW	ratio of a power to 1 watt, expressed in decibels
dBpW	ratio of a power to 1 picowatt, expressed in decibels
dB μ V/m	ratio of an electric field to 1 μ V/m, expressed in decibels (20 log(electric field / 1 μ V/m))

3.3 Abbreviations

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

ACF	Antenna Control Facility
BDC	Block Down Converter
Bo	occupied Bandwidth
BSS	Broadcast Satellite Service
BUC	Block Up Converter
CC	Control Channel
CCF	Control Channel reception Failure
CCR	Control Channel correctly Received
CENR	Cessation of Emissions Not Requested
CEPT	Conférence Européenne des Postes et Télécommunications (European Conference of Postal and Telecommunications Administrations)
CER	Cessation of Emissions Requested
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
CMF	Control and Monitoring Functions
e.i.r.p.	equivalent isotropically radiated power
ECC	Electronic Communications Committee (of CEPT)
EMC	Electro-Magnetic Compatibility
EME	Externally Mounted Equipment
EN	European Standard
EUT	Equipment Under Test
FEC	Forward Error Correction
FS	Fixed Service
FSS	Fixed Satellite Service
GSO	Geostationary Satellite Orbit
HPA	High Power Amplifier
IME	Internally Mounted Equipment
IPR	Intellectual Property Rights
ITU	International Telecommunications Union
LNB	Low Noise Block down converter
LO	Local Oscillator
LV	Low Voltage
OFDM	Orthogonal Frequency Division Multiplexing
PAME	Polarization Angle Misalignment Error
R&TTE	Radio and Telecommunications Terminal Equipment
RC	Response Channel
RF	Radio Frequency
SMF	System Monitoring Fail
SMP	System Monitoring Pass
STE	Special Test Equipment
TDMA	Time Division Multiple Access
TxD	Transmission Disable command
TxE	Transmission Enable command
VMES	Vehicle-Mounted Earth Station