
**Elektromagnetna združljivost in zadeve v zvezi z radijskim spektrom (ERM) -
Naprave kratkega dosega - Cestna transportna in prometna telematika (RTTT) -
Oprema za radar kratkega dosega, ki deluje v frekvenčnem območju 24 GHz - 1.
del: Tehnične zahteve in merilne metode**

Electromagnetic compatibility and Radio spectrum Matters (ERM) - Short Range Devices
- Road Transport and Traffic Telematics (RTTT) - Short range radar equipment operating
in the 24 GHz range - Part 1: Technical requirements and methods of measurement

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 302 288-1 V1.6.1:2012](https://standards.iteh.ai/catalog/standards/sist/cbeb5831-9658-4452-8685-77d895446f19/sist-en-302-288-1-v1-6-1-2012)

<https://standards.iteh.ai/catalog/standards/sist/cbeb5831-9658-4452-8685-77d895446f19/sist-en-302-288-1-v1-6-1-2012>

Ta slovenski standard je istoveten z: EN 302 288-1 Version 1.6.1

ICS:

33.060.99	Druga oprema za radijske komunikacije	Other equipment for radiocommunications
33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general
35.240.60	Uporabniške rešitve IT v transportu in trgovini	IT applications in transport and trade

SIST EN 302 288-1 V1.6.1:2012

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 302 288-1 V1.6.1:2012

<https://standards.iteh.ai/catalog/standards/sist/cbeb5831-9658-4452-8685-77d895446f19/sist-en-302-288-1-v1-6-1-2012>

ETSI EN 302 288-1 V1.6.1 (2012-03)



**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Short Range Devices;
Road Transport and Traffic Telematics (RTTT);
Short range radar equipment operating in the 24 GHz range;
Part 1: Technical requirements and
methods of measurement**

Reference

 REN/ERM-TGSRR-056-1

Keywords

 radar, radio, RTTT, SRD, testing

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 302 288-1 V1.6.1:2012

<https://standards.iteh.ai/catalog/standards/sist/cbeb5831-9658-4452-8685-77d8954461f7/ETSI-EN-302-288-1-v1-6-1-2012>

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 2012.
 All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE™** are Trade Marks of ETSI 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
1 Scope	7
2 References	7
2.1 Normative references	7
2.2 Informative references.....	8
3 Definitions, symbols and abbreviations	9
3.1 Definitions.....	9
3.2 Symbols.....	10
3.3 Abbreviations	11
4 Technical requirements specifications	12
4.1 Presentation of equipment for testing purposes.....	12
4.1.1 Choice of model for testing	12
4.2 Mechanical and electrical design.....	12
4.3 Auxiliary test equipment	12
4.4 Interpretation of the measurement results	12
5 Test conditions, power sources and ambient temperatures	13
5.1 Normal and extreme test conditions	13
5.2 External test power source.....	13
5.3 Normal test conditions.....	13
5.3.1 Normal temperature and humidity.....	13
5.3.2 Normal test power source	13
5.3.2.1 Mains voltage.....	13
5.3.2.2 Other power sources.....	13
5.4 Extreme test conditions	14
5.4.1 Extreme temperatures	14
5.4.1.1 Procedure for tests at extreme temperatures.....	14
5.4.1.2 Extreme temperature ranges.....	14
5.4.2 Extreme test source voltages.....	14
5.4.2.1 Mains voltage	14
5.4.2.2 Other power sources.....	14
6 General conditions.....	14
6.1 Test fixture	14
6.1.1 Requirements	14
6.1.2 Calibration	15
6.1.3 General requirements for RF cables.....	17
6.1.4 Shielded anechoic chamber.....	18
7 Methods of measurement and limits for transmitter parameters	19
7.1 Methods of measurement and limits for transmitters in the 22,000 GHz to 26,65 GHz band for type A and B	19
7.1.1 Permitted range of operating frequencies	19
7.1.1.1 Definition	19
7.1.1.2 Method of measurement.....	19
7.1.1.3 Limits	20
7.1.1.3.1 Limits for type A	20
7.1.1.3.2 Limits for type B	20
7.1.2 Maximum radiated average power density (e.i.r.p.)	20
7.1.2.1 Definition	20
7.1.2.2 Method of measurement.....	20
7.1.2.3 Limits for UWB maximum radiated average power density (e.i.r.p.) for type A.....	22
7.1.2.4 Limits for UWB maximum radiated average power density (e.i.r.p.) for type B.....	22
7.1.3 Maximum radiated peak power density (e.i.r.p.)	23

7.1.3.1	Definition	23
7.1.3.2	Method of measurement.....	23
7.1.3.3	Standard procedure and setup extensions.....	24
7.1.3.4	Limits for UWB maximum radiated peak power density (e.i.r.p.) for type A	24
7.1.3.5	Limits for UWB maximum radiated peak power density (e.i.r.p.) for type B.....	25
7.1.4	Methods of measurement and limits for emissions in the 24,05 GHz to 24,25 GHz band	26
7.1.4.1	Equivalent isotropically radiated power (e.i.r.p.).....	26
7.1.4.1.1	Definition.....	26
7.1.4.1.2	Method of measurement	26
7.1.4.1.3	Limits	28
7.1.4.2	Permitted range of operating frequencies.....	28
7.1.4.2.1	Definition.....	28
7.1.4.2.2	Method of measurement for equipment not using FH modulation.....	28
7.1.4.2.3	Method of measurement for equipment using pulsed FH modulation.....	29
7.1.4.2.4	Limit.....	30
7.1.5	Vertical plane transmitter emissions in the 23,6 GHz to 24 GHz band	30
7.1.5.1	Definition	30
7.1.5.2	Measurement procedure	30
7.1.5.3	Vertical emission limits in the 23,6 GHz to 24,0 GHz band for type A.....	30
7.1.5.4	Emission limits for Type B	30
7.2	Radiated emissions in the non-operating-frequency range	31
7.2.1	Definition.....	31
7.2.2	Measuring receiver	31
7.2.3	Method of measurement for emissions in the non-operating frequency range	31
7.2.4	Limits.....	32
8	Methods of measurement and limits for receiver parameters.....	32
8.1	Receiver spurious emissions.....	32
8.1.1	Definition.....	32
8.1.2	Method of measurement - radiated spurious emissions.....	32
8.1.3	Limit	33
9	Measurement uncertainty	33
Annex A (normative):	Radiated measurements.....	35
A.1	Test sites and general arrangements for measurements involving the use of radiated fields.....	35
A.2	Guidance on the use of radiation test sites	35
A.2.1	Substitution antenna	35
A.3	Indoor test site using a fully anechoic RF chamber	35
A.3.1	Example of the construction of a shielded anechoic chamber.....	35
A.3.2	Influence of parasitic reflections in anechoic chambers.....	37
A.3.3	Calibration of the shielded RF anechoic chamber.....	37
Annex B (normative):	General description of measurement methods.....	38
B.1	Radiated measurements.....	38
B.2	Performance requirements for preamplifier and horn antenna.....	39
B.3	Measurement of the residual carrier	39
Annex C (informative):	Example of modulation schemes.....	40
C.1	Pseudo Noise Pulse Position Modulation (PN PPM).....	40
C.1.1	Definition	40
C.1.2	Typical operation parameters	41
C.2	Pulsed FH (Pulsed Frequency Hopping).....	41
C.2.1	Definition	41
C.2.2	Typical operation parameters	42
C.2.3	Additional requirements for pulsed FH equipment measurement	42
C.2.3.1	Pulsed FH modulation	42
C.2.3.2	Measurement requirements.....	42

C.3	PN-2-PSK (Pseudo noise binary coded phase shift keying).....	43
C.3.1	Definition	43
C.3.2	Typical operation parameters	44
Annex D (normative):	General description of Type A: Short range radar equipment operating in the range from 22,000 GHz to 26,65 GHz.....	45
Annex E (normative):	General description of Type B: Short range radar equipment operating in the range from 24,25 GHz to 26,65 GHz.....	46
Annex F (informative):	Typical antenna elevation pattern for a 26 GHz SRR in the passive band and the averaged elevation pattern above 30°	47
Annex G (normative):	Installation requirements of 24 GHz Short Range Radar (SRR) systems	48
G.1	Installation requirements for type A.....	48
G.2	Installation requirements for Type B.....	49
Annex H (informative):	Conversion of power density to e.i.r.p.....	50
H.1	Assumptions	50
H.2	Example.....	50
Annex I (informative):	Bibliography.....	51
History		52

ITeH STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 302 288-1 V1.6.1:2012](https://standards.iteh.ai/catalog/standards/sist/cbeb5831-9658-4452-8685-77d895446f19/sist-en-302-288-1-v1-6-1-2012)

<https://standards.iteh.ai/catalog/standards/sist/cbeb5831-9658-4452-8685-77d895446f19/sist-en-302-288-1-v1-6-1-2012>

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://ipr.etsi.org>).

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

For non EU countries the present document may be used for regulatory (Type Approval) purposes.

Equipment compliant with the present document is intended for fitment into road vehicles, therefore it is subject to automotive EMC type approval and has to comply with Directive 95/54/EC [4]. For use on vehicles outside the scope of Directive 95/54/EC [4] compliance with an EMC directive/standard appropriate for that use is required.

The present document is part 1 of a multi-part deliverable covering Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices, Road Transport and Traffic Telematics (RTTT); Short range radar equipment operating in the 24 GHz range, as identified below:

Part 1: "Technical requirements and methods of measurement";

Part 2: "Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

SIST EN 302 288-1 V1.6.1:2012

[https://standards.iteh.ai/catalog/standards/sist/c6e63851-9658-4452-8685-](https://standards.iteh.ai/catalog/standards/sist/c6e63851-9658-4452-8685-77d895446f19/sist-en-302-288-1-v1-6-1-2012)

77d895446f19/sist-en-302-288-1-v1-6-1-2012

National transposition dates

Date of adoption of this EN:	19 March 2012
Date of latest announcement of this EN (doa):	30 June 2012
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2012
Date of withdrawal of any conflicting National Standard (dow):	31 December 2012

1 Scope

The present document specifies the technical requirements and methods of measurement for Short Range Devices (SRD) working as UWB devices with at least 500 MHz bandwidth in the 22,000 GHz to 26,65 GHz frequency range intended for Road Transport and Traffic Telematics (RTTT) applications, such as automotive 24 GHz Short Range Radar (SRR) for e.g. obstacle detection, stop and go, blind spot detection, parking aid, backup aid, precrash and other automotive applications.

The present document covers transmitters intended to operate in a temporary frequency designation under the 24 GHz ECC decision CEPT/ECC/DEC/(04)10 [i.7], the EU Commission decision on 24 GHz SRR 2005/50/EC [i.1] and the amendment as presented in RSCOM11-07 21 [i.8].

The operating frequency range for intentional UWB emissions with at least 500 MHz bandwidth in the 22,000 GHz to 26,65 GHz range until 30th June 2013 as given in annex D and from 24,25 GHz to 26,65 GHz until 1st January 2018 as given in annex E. However, the date of 1 January 2018 will be extended by 4 years for automotive short-range radar equipment mounted on motor vehicles for which a type approval application has been submitted pursuant to Article 6(6) of Directive 2007/46/EC [6] and has been granted before 1 January 2018.

The present document applies to:

- a) Transmitters in the range from 22,000 GHz to 26,65 GHz operating as UWB devices over the specific bandwidth defined for the individual devices.
- b) Receivers operating in the range from 22,000 GHz to 26,65 GHz.
- c) Integrated transceivers.

The present document contains the technical characteristics and test methods for short range radar equipment fitted with integral antennas.

The present document does not necessarily include all the characteristics which may be required by a user, nor does it necessarily represent the optimum performance achievable.

The present document covers short range radar mobile applications. The present document covers only SRR equipment for road vehicles.

The present document complies with field limits for human exposure to electromagnetic fields as provided by the EC Recommendation 1999/519/EC [i.2] and the methods for compliance demonstration in EN 50371 [i.3].

2 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.

2.1 Normative references

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

- [1] CISPR 16 (parts 1-1, 1-4 and 1-5): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".
- [2] CEPT/ERC/REC 01-06: "Procedure for mutual recognition of type testing and type approval for radio equipment".

- [3] ETSI TR 100 028 (V1.4.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [4] Commission Directive 95/54/EC of 31 October 1995 adapting to technical progress Council Directive 72/245/EEC on the approximation of the laws of the Member States relating to the suppression of radio interference produced by spark-ignition engines fitted to motor vehicles and amending Directive 70/156/EEC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers.
- [5] ETSI EN 302 288-2 (V1.3.2): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices; Road Transport and Traffic Telematics (RTTT); Short range radar equipment operating in the 24 GHz range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".
- [6] Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007, establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles.

NOTE: See <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:263:0001:0001:EN:PDF>.

2.2 Informative references

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] Commission Decision 2005/50/EC of 17 January 2005 on the harmonization of the 24 GHz range radio spectrum band for the time-limited use by automotive short-range radar equipment in the Community.
- [i.2] Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz).
- [i.3] CENELEC EN 50371 (2002); "Generic standard to demonstrate the compliance of low power electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 GHz) - General public".
- [i.4] ETSI TR 102 273-2 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 2: Anechoic chamber".
- [i.5] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".
- [i.6] CEPT/ERC/REC 74-01: "Unwanted emissions in the spurious domain".
- [i.7] CEPT/ECC/DEC/(04)10: "ECC Decision of 12 November 2004 on the frequency bands to be designated for the temporary introduction of Automotive Short Range Radars (SRR)", (Amended 2005).
- [i.8] RSCOM11-21, Amending Decision 2005/50/EC on the harmonisation of the 24 GHz range radio spectrum band for the time-limited use by automotive short-range radar equipment in the Community.
- [i.9] ECC Report 158: "The impact of 26 GHz SRR applications using ultra-wideband (UWB) technology on radio services".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

activity factor: actual on-the-air time divided by active session time or actual on-the-air emission time within a given time window

antenna scan duty factor: ratio of the area of the beam (measured at its -3 dB point) to the total area scanned by the antenna (as measured at its -3 dB point)

assigned frequency band: frequency band within which the device is authorized to operate

associated antenna: antenna and all its associated components which are designed as an indispensable part of the equipment

average time: time interval on which a mean measurement is integrated

blanking period: time period where either no waveform or a constant waveform within the 24 GHz SRD band occurs

boresight: axis of the main beam in a directional antenna

channel dwell duty cycle: ratio of the time of uninterrupted continuous transmission within a given frequency channel to the channel repetition interval

NOTE: Channel dwell time/channel repetition interval.

channel dwell time: accumulated amount of transmission time of uninterrupted continuous transmission within a single given frequency channel and within one channel repetition interval

duty cycle: ratio of the total on time of the "message" to the total off time in any one hour period

NOTE: The device may be triggered either automatically or manually, whether the duty cycle is fixed or random depends on how the device is triggered.

Equipment Under Test (EUT): radar sensor including the integrated antenna together with any external antenna components which affect or influence its performance

equivalent isotropically radiated power (e.i.r.p.): total power or power density transmitted, assuming an isotropic radiator

NOTE: e.i.r.p. is conventionally the product of "power or power density into the antenna" and "antenna gain". E.i.r.p. is used for both peak or average power and peak or average power density.

equivalent pulse power duration: duration of an ideal rectangular pulse which has the same content of energy compared with the pulse shape of the EUT with pulsed modulation or on-off gating

far field measurement: measurement at a distance "X" of at least $2d^2/\lambda$, where d is the largest dimension of the antenna aperture of the EUT

maximum safe level for radiated power density: level which can be transmitted in accordance with the current recommended safety levels in Council Recommendation 1999/519/EC [i.2]

on-off gating: methods of transmission with fixed or randomly quiescent period that is much larger than the PRF

operating frequency (operating centre frequency): nominal frequency at which equipment is operated

NOTE: Equipment may be able to operate at more than one operating frequency.

operating frequency range: range of operating frequencies over which the equipment can be adjusted through switching or reprogramming or oscillator tuning

NOTE 1: For pulsed or phase shifting systems without further carrier tuning the operating frequency range is fixed on a single carrier line.

NOTE 2: For analogue or discrete frequency modulated systems (FSK, FMCW) the operating frequency range covers the difference between minimum and maximum of all carrier frequencies on which the equipment can be adjusted.

power envelope: power supplied to the antenna by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions

Power Spectral Density (PSD): ratio of the amount of power to the used radio measurement bandwidth

NOTE: It is expressed in units of dBm/Hz or as a power in unit dBm with respect to the used bandwidth. In case of measurement with a spectrum analyser the measurement bandwidth is equal to the RBW.

precrash: time before the crash occurs when safety mechanism are deployed

Pulse Repetition Frequency (PRF): inverse of the Pulse Repetition Interval, averaged over a time sufficiently long as to cover all PRI variations

Pulse Repetition Interval (PRI): time between the rising edges of the transmitted (pulsed) output power

quiescent period: time instant where no intentional emission occurs

radome: external protective cover which is independent of the associated antenna, and which may contribute to the overall performance of the antenna (and hence, the EUT)

spatial radiated power density: power per unit area normal to the direction of the electromagnetic wave propagation

NOTE: Spatial radiated power density is expressed in units of W/m².

spread spectrum: telecommunications techniques in which a signal is transmitted in a bandwidth considerably greater than the frequency content of the original information

ultra wideband: classification of the spectral width of a transmission system

ultra-wideband bandwidth: equipment using ultra-wideband technology means equipment incorporating, as an integral part or as an accessory, technology for short-range radiocommunication, involving the intentional generation and transmission of radio-frequency energy that spreads over a frequency range wider than 50 MHz

3.2 Symbols

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

λ	wavelength
ac	alternating current
B	bandwidth
B_{FH}	frequency hopping bandwidth
d	largest dimension of the antenna aperture
D_{fb}	distance of ferrite beads
E	field strength
E_o	reference field strength
f_c	carrier frequency
f_{hop}	hopping frequency
f_h	highest frequency
f_l	lowest frequency
G_a	antenna gain
P_{rad}	radiated power
$P_{PK\ 3\ MHz}$	radiated peak power measured in 3 MHz bandwidth

P_s	signal generator power
R	distance
R_o	reference distance
τ	pulse width
T_{blk}	blank time period
T_c	chip period
T_{dw}	dwelt time
T_{fr}	frame time
T_{pw}	pulse power duration

3.3 Abbreviations

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

BPSK	Binary Phase Shift Keying
CW	Continuous Wave
dB	decibel
dBi	gain in decibels relative to an isotropic antenna
DSB	Dual Side Band
DSS	Direct Sequence Signal
e.i.r.p.	equivalent isotropically radiated power
ECC	Electronic Communications Committee
EMC	Electro Magnetic Compatibility
ERC	European Radiocommunication Committee
EUT	Equipment Under Test
FH	Frequency Hopping
FHSS	Frequency Hopping Spread Spectrum
FMCW	Frequency Modulated Continuous Wave
FSK	Frequency Shift Keying
IF	Intermediate Frequency
LNA	Low Noise Amplifier
PDCF	Pulse Desensitization Correction Factor
PM	Pulse Modulation
PN	Pseudo Noise
PPM	Pulse Position Modulation (staggered)
PRF	Pulse Repetition Frequency
PRI	Pulse Repetition Interval
PSK	Phase Shift Keying
R&TTE	Radio and Telecommunications Terminal Equipment
r.m.s.	root mean square
RAS	Radio Astronomy Site
RBW	Resolution BandWidth
RF	Radio Frequency
RMS	Root Mean Square
RTTT	Road Transport and Traffic Telematics
Rx	Receiver (Receive)
SA	Spectrum Analyser
SNR	Signal to Noise Ratio
SPM	Staggered Pulse Position Modulated
SRD	Short Range Device
SRR	Short Range Radar
Tx	Transmitter
UWB	UltraWide Band
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specifications

4.1 Presentation of equipment for testing purposes

Each equipment submitted for testing, where applicable, shall fulfil the requirements of the present document on all frequencies over which it is intended to operate. EMC type approval testing to Directive 95/54/EC [4] shall be done on the vehicle.

The provider shall provide one or more samples of the equipment, as appropriate for testing.

Additionally, technical documentation and operating manuals, sufficient to allow testing to be performed, shall be supplied.

The performance of the equipment submitted for testing shall be representative of the performance of the corresponding production model. In order to avoid any ambiguity in that assessment, the present document contains instructions for the presentation of equipment for testing purposes, conditions of testing (clause 5) and the measurement methods (clauses 7 and 8). Instructions for installation of the equipment in a road vehicle are provided in annex D.

Stand alone equipment submitted for testing shall be offered by the provider complete with any ancillary equipment needed for testing. The provider shall declare the frequency range(s), the range of operation conditions and power requirements, as applicable, in order to establish the appropriate test conditions.

The EUT will comprise the sensor, antenna and radome if needed and will be tested as a standalone assembly. The EUTs test fixtures may be supplied by the provider to facilitate the tests (clause 6.1).

These clauses are intended to give confidence that the requirements set out in the present document have been met without the necessity of performing measurements on all frequencies.

4.1.1 Choice of model for testing

If an equipment has several optional features, considered not to affect the RF parameters then the tests need only to be performed on the equipment configured with that combination of features considered to be the most complex, as proposed by the provider and agreed by the test laboratory.

4.2 Mechanical and electrical design

The equipment submitted by the provider shall be designed, constructed and manufactured in accordance with good engineering practice and with the aim of minimizing harmful interference to other equipment and services.

Transmitters and receivers may be individual or combination units.

4.3 Auxiliary test equipment

All necessary test signal sources and set-up information shall accompany the equipment when it is submitted for testing.

4.4 Interpretation of the measurement results

The interpretation of the results recorded on the appropriate test report for the measurements described in the present document shall be as follows:

- the measured value relating to the corresponding limit shall be used to decide whether an equipment meets the requirements of the present document;
- the measurement uncertainty value for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall, for each measurement, be equal to, or lower than, the figures in the table of measurement uncertainty (table 9).

5 Test conditions, power sources and ambient temperatures

5.1 Normal and extreme test conditions

Testing shall be carried out under normal test conditions, and also, where stated, under extreme test conditions.

The test conditions and procedures shall be as specified in clauses 5.2 to 5.4.

5.2 External test power source

During tests the power source of the equipment shall be an external test power source, capable of producing normal and extreme test voltages as specified in clauses 5.3.2 and 5.4.2. The internal impedance of the external test power source shall be low enough for its effect on the test results to be negligible.

The test voltage shall be measured at the point of connection of the power cable to the equipment.

During tests the external test power source voltages shall be within a tolerance of ± 1 % relative to the voltage at the beginning of each test. The level of this tolerance can be critical for certain measurements. Using a smaller tolerance provides a reduced uncertainty level for these measurements.

5.3 Normal test conditions

5.3.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- temperature: +15 °C to +35 °C
- relative humidity: 20 % to 75 %.

When it is impracticable to carry out tests under these conditions, a note to this effect, stating the ambient temperature and relative humidity during the tests, shall be added to the test report.

5.3.2 Normal test power source

The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of the tests, the voltage of the external test power source shall be measured at the input terminals of the equipment.

5.3.2.1 Mains voltage

The normal test voltage for equipment shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages, for which the equipment was designed.

The frequency of the test power source corresponding to the ac mains shall be between 49 Hz and 51 Hz.

5.3.2.2 Other power sources

For operation from other power sources the normal test voltage shall be that declared by the provider. Such values shall be stated in the test report.