SLOVENSKI STANDARD
SIST EN 302 288-1 V1.4.1:2009

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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

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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

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Foreword

This European Standard (Telecommunications series) 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".

National transposition dates	
Date of adoption of this EN:	22 January 2009
Date of latest announcement of this EN (doa):	30 April 2009
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 October 2009
Date of withdrawal of any conflicting National Standard (dow):	31 October 2009

1 Scope

The present document specifies the technical requirements and methods of measurement for Short Range Devices (SRD) working as broadband 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 application is also subject to the EU Commission decision on 24 GHz SRR 2005/50/EC [i.1].

The present document applies to:

a) Transmitters in the range from 22,000 GHz to 26,65 GHz operating as broadband 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 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] 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 (V1.2.2): "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".

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] 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).

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

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/m^2.

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
Rx	Receiver
τ	Pulse width
T_{blk}	Blank time period
T_c	Chip period
T_{dw}	Dwell time
T_{fr}	Frame time
T_{pw}	Pulse power duration
Tx	Transmitter

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.m.s.	root mean square
R&TTE	Radio and Telecommunications Terminal Equipment
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
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio