



SLOVENSKI STANDARD

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Elektromagnetna združljivost in zadeve v zvezi z radijskim spektrom (ERM) – Cestna transportna in prometna telematika (RTTT) – Oddajniška oprema za enouporniško (osebno) komunikacijo kratkega dosega (DSRC) (s prenosnima hitrostma 500 kbit/s / 250 kbit/s), ki deluje v pasu 5,8 GHz, namenjenem industrijski, znanstveni in medicinski uporabi – 1. del: Splošne karakteristike in preskusne metode za obcestne enote (RSU) in enote na vozilu (OBU)

iTeh STANDARD PREVIEW

Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band; Part 1: General characteristics and test methods for Road Side Units (RSU) and On-Board Units (OBU)

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European Standard (Telecommunications series)

**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Road Transport and Traffic Telematics (RTTT);
Dedicated Short Range Communication (DSRC)
transmission equipment (500 kbit/s / 250 kbit/s) operating in
the 5,8 GHz Industrial, Scientific and Medical (ISM) band;
Part 1: General characteristics and test methods
for Road Side Units (RSU) and On-Board Units (OBU)**

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document is part 1 of a multi-part deliverable covering Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band, as identified below:

Part 1: "General characteristics and test methods for Road Side Units (RSU) and On-Board Units (OBU)";

Part 2: "Harmonized EN under article 3.2 of the R&TTE Directive".

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National transposition dates

Date of adoption of this EN:	31 July 2004
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1 Scope

The present document applies to Road Transport and Traffic Telematics (RTTT) wireless systems:

- with or without antenna connectors;
- for digital data transmission;
- operating on radio frequencies in the 5,725 GHz to 5,875 GHz Industrial, Scientific and Medical (ISM) frequency band.

The applicability of the present document covers both the Road Side Units (RSUs) and the On-Board Units (OBUs) with transceivers and transponders.

The present document complies with ECC/DEC/(02)01 [1] and CEPT/ERC/REC 70-03 [3]. It is a specific standard covering various RTTT applications.

Additional standards or specifications may be required for equipment such as that intended for connection to the Public Switched Telephone Network (PSTN) or other systems.

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>.

- [1] ECC/DEC/(02)01: "ECC Decision of 15 March 2002 on the frequency bands to be designated for the coordinated introduction of Road Transport and Traffic Telematic Systems".
- [2] CENELEC EN 12253 (2003): "Road transport and traffic telematics. Dedicated short-range communication. Physical layer using microwave at 5,8 GHz".
- [3] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".
- [4] 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".
- [5] IEC 60721-3-4 (1995) including Amendment 1 (1996): "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weather protected locations".
- [6] IEC 60721-3-5 (1997): "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 5: Ground vehicle installations".
- [7] BS EN 12795 (2003): "Road transport and traffic telematics. Dedicated short range communication (DSRC). DSRC data link layer. Medium access and logical link control".
- [8] BS EN 12834 (2003): "Road transport and traffic telematics. Dedicated Short Range Communication (DSRC). DSRC application layer".
- [9] ISO/TR 14906 (1998): "Road Transport and Traffic Telematics (RTTT) - Electronic Fee Collection (EFC) - Application interface definition for dedicated short range communications".

- [10] CEPT/ERC/REC 74-01E (2002): "Spurious Emissions".
- [11] 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".
- [12] ETSI TR 102 273-4 (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 4: Open area test site".
- [13] ETSI TR 102 273-6 (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 6: Test fixtures".
- [14] CENELEC EN 13372 (2003): "Road transport and traffic telematics (RTTT). Dedicated short-range communication. Profiles for RTTT applications".
- [15] 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.
- [16] CISPR 16-1 Edition 2.1 (2002): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus".

3 Definitions, symbols and abbreviations

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3.1 Definitions

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

adjacent channel: A downlink adjacent channel refers to transmission in downlink direction using any one of the adjacent DSRC downlink channels at a distance of 5 MHz, i.e. in the channel at the next upper or lower centre frequency. An uplink adjacent channel refers to transmission in uplink direction using any one of the uplink communication channels related to a centre frequency at a distance of 5 MHz relative to the own downlink centre frequency.

bit: acronym for "binary digit" which can have one out of two possible values, e.g. 0/1 or +1/-1 or low/high

bit rate: in a bit stream, the number of bits occurring per unit time, usually expressed in bits per second

bore sight: direction of maximum radiation of a directional antenna

NOTE: If bore sight can not be determined unambiguously, then bore sight may be declared by the provider.

carrier frequency: frequency f_{TX} to which the RSU transmitter is tuned

NOTE: In DSRC, the carrier frequency is in the centre of a channel, see table 2 of the present document.

carrier signal or carrier: harmonic signal whose nominal single frequency f_{TX} can vary within a range specified by the carrier frequency tolerance and which is capable of being modulated by a second, symbol-carrying signal

channel: continuous part of the radio-frequency spectrum to be used for a specified emission or transmission

NOTE: A radio-frequency channel may be defined by two specified limits, or by its centre frequency and its bandwidth, or any equivalent indication. It is often designated by a sequential number. A radio-frequency channel may be time-shared in order to allow radiocommunication in both directions by simplex operation. The term "channel" is sometimes used to denote two associated radio-frequency channels, each of which is used for one of two directions of transmission, i.e. in fact a telecommunication circuit.

co-channel: A downlink co-channel refers to a transmission in downlink direction using the same frequency band of 5 MHz width. Up-link channels at the two sub-carrier frequencies related to the same downlink channel (downlink centre frequency) are referred to as co-channels.

cross-polar discrimination, ellipticity of polarization: Antenna designed to transmit left hand circular waves may transmit some right hand circular waves in addition. Cross-Polar Discrimination (XPD) is defined as the ratio $P_{\text{LHCP}}/P_{\text{RHCP}}$ of power P_{LHCP} of the left hand circular polarized wave to the power P_{RHCP} of the right hand circular wave when the total power of the transmitted wave is $P_{\text{LHCP}} + P_{\text{RHCP}}$.

environmental profile: range of environmental conditions under which equipment within the scope of EN 300 674-1 is required to comply with the provisions of EN 300 674-1

equivalent isotropically radiated power: signal power fed into an ideal loss-less antenna radiating equally in all directions that generates the same power flux at a reference distance as the one generated by a signal fed into the antenna under consideration in a predefined direction within its far field region

integral antenna: antenna, with or without a connector, designed as an indispensable part of the equipment

OBU sleep mode: OBU may be either in sleep mode, the stand-by mode, or the transmit mode. The sleep mode is an optional mode for battery powered OBUs that allows to save battery power. In this mode, the OBU can only detect the presence of a DSRC down-link signal which under certain defined conditions, see EN 12253 [2], will lead to wake-up, i.e. a transition to the stand-by mode.

OBU stand-by mode: OBU may be either in sleep mode, the stand-by mode, or the transmit mode. The stand-by mode is the mode, in which the OBU is capable of receiving DSRC down-link signals. In this mode the OBU is never transmitting.

operating frequency: nominal frequency at which equipment is operated; also referred to as the operating centre frequency

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

out-of-band emissions: emissions on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process and which cannot be reduced without affecting the corresponding transmission of information, but excluding spurious emissions (see also CEPT Recommendation 74-01 [10])

polarization: Locus of the tip of the electrical field vector in a plane perpendicular to the direction of transmission. Examples are horizontal and vertical linear polarization and left and right hand circular polarization.

Portable Equipment (PE): generally intended to be self-contained, free standing and portable

NOTE: A PE would normally consist of a single module, but may consist of several interconnected modules. It is powered by one or more internal batteries.

provider: manufacturer or person responsible for placing the apparatus on the market

radiated measurements: measurements which involve the measurement of a radiated electromagnetic field

spurious emissions: Emission on a frequency, or frequencies, which are outside an exclusion band of $\pm 2,5$ times the channel spacing around the selected centre frequency f_{Tx} , and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of-band emissions (see also CEPT Recommendation 74-01 [10]).

3.2 Symbols

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

A_{CW}	Amplitude of CW signal
A_{mod}	Amplitude of modulated signal
ATN_{AT2}	Attenuation of attenuator AT2
ATN_{BLN}	Attenuation of balun BLN

ATN_{CA1}	Attenuation of calibrated coaxial cable 1
BER	Bit Error Ratio
C_F	Number of frames transmitted
C_E	Number of erroneous frames received
d	Distance between phase centres of transmitting and receiving antenna
$d_{displace}$	Horizontal displacement of TTA and RTA antenna phase centres
d_{F1}	Distance from transmitting antenna to first Fresnel ellipse
d_{F2}	Distance from first Fresnel ellipse to receiving antenna
D_{fb}	Distance between neighbouring ferrite beads
D_i	Directivity relative to an isotropic radiator
$D_{0,TA}$	Largest linear dimension of test antenna
$D_{0,EUT}$	Largest linear dimension of EUT antenna
$EIRP_{max}$	Maximum e.i.r.p. of RSU
$EIRP_{MaxObuTx}$	Maximum e.i.r.p. generated by the OBU in a single side band
$EIRP_{ObuTx}$	e.i.r.p. generated by the OBU within a single side band
$EIRP_{OBU}$	e.i.r.p. generated by the OBU antenna
$EIRP_{TSM}$	e.i.r.p. referred to transmitter spectrum mask
Δf_{RSU}	Frequency error of RSU
Δf_s	Sub-carrier frequency error
f	Frequency
f_c	Centre frequency of receiving device
FER	Frame error ratio
f_{ObuTx}	Actual centre frequency of the lower and upper side band of the OBU up-link channel
f_{MSS1}	Frequency of MSS1
f_{offset}	Offset frequency
f_s	Nominal OBU sub-carrier frequency
f_{Tx}	Nominal RSU carrier frequency
$f_{Tx,actual}$	Actual centre frequency of the down-link carrier
f_u	Nominal centre frequency of unwanted signal
f_{u1}, f_{u2}	Centre frequencies of unwanted signal
G_c	Conversion gain
G_{corr}	Correction gain
$G_{OBU,Rx}$	Gain of OBU receiving antenna
$G_{OBU,Tx}$	Gain of OBU transmitting antenna
G_{RSA}	Gain of receiving substitution antenna
G_{TA}	Gain of test antenna
G_{TSA}	Gain of transmitting substitution antenna
$G_{RSU,Tx}$	Gain of RSU transmitting antenna
k	Expansion factor (coverage factor)
$\lg(.)$	Logarithm to the base ten
m	Modulation index
N	Total number of transmitted bits within a single frame
P_{CW}	Power of CW signal
P_{D11a}	Power limit for communication (upper)
P_{D11b}	Power limit for communication (lower)
P_{inc}	Incident signal power as received by an ideal isotropical receiving antenna
$P_{inc,scan}$	Incident signal power obtained from a scanning process
$P_{inc,dBm}$	P_{inc} in dBm
P_{LHCP}	Signal power of left hand circular polarized wave
P_{max}	Maximum signal power
P_{mod}	Power of modulated signal
P_{MMS1}	Output signal power of MSS1

P_{MMS2}	Output signal power of MSS2
P_{ObuRx}	Incident signal power to OBU, referred to an ideal isotropical receiving antenna
P_{pol}	Signal power of wave with corresponding polarization
P_{v}	Signal power of wave featuring vertical polarization
P_{h}	Signal power of wave featuring horizontal polarization
P_{PM1}	Signal power measured by the power meter 1
P_{ref}	Reference signal power limit in Watt
$P_{\text{ref,dBm}}$	Reference signal power limit in dBm
P_{reTx}	Retransmitted signal power
P_{RSA}	Signal power obtained from receiving substitution antenna
P_{RHCP}	Signal power of right hand circular polarized wave
P_{ssb}	Signal power within single side band
P_{sens}	Declared sensitivity of receiver
P_{spurious}	Signal power of spurious signal
P_{tot}	Sum of signal power $P_1 + P_2$, or $P_1 + P_2 + \dots + P_5$, whichever applies
$P_{\text{tot,dBm}}$	P_{tot} in dBm
P_{TSM}	Transmitter spectrum mask
P_{u}	Power of unwanted signal
P_{w}	Signal power of wanted signal
P_0	Reference signal power of 1 mW corresponding to 0 dBm
RBW	Resolution bandwidth
T_{CW}	Duration of CW signal
T_{mod}	Duration of modulated signal
$V_{\text{max}}, V_{\text{min}}$	Maximal amplitude of modulated output signal of RSU caused by data bit 1, or 0
α	Tilt angle of test antenna
α_{displace}	Displacement angle between TTA and RTA
θ	Angle relative to OBU bore sight indicating worst case direction
λ	Wavelength
ρ_{RSA}	Reflection coefficient at antenna connector of the receiving substitution antenna
ρ_{TSA}	Reflection coefficient at antenna connector of the transmitting substitution antenna

3.3 Abbreviations

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

General abbreviations:

AT1	Attenuator 1
AT2	Attenuator 2
BER	Bit Error Ratio
BLN	Balun
BST	Beacon Service table
CA	Corresponding Antenna
CC	Coaxial Circulator
CRC	Cyclic Redundancy Checking
CW	Continuous Wave
DC	Direct Current
DEC	DECision
doa	date of announcement
dop	date of publication
dow	date of withdrawal
DSRC	Dedicated Short Range Communication
e.i.r.p.	Equivalent Isotropically Radiated Power also called EIRP, eirp, E.I.R.P.
EC	European Community
ECC	European Community Commission

EFC	Electronic Fee Collection
EUT	Equipment Under Test
FCCA	Ferrited Coaxial CAble
FCCA1	Ferrited Coaxial CAble 1
FER	Frame Error Ratio
ISM	Industrial, Scientific, Medical
LHCP	Left Hand Circular Polarized
LOS	Line-Of-Sight
LP	Linear Polarized
Mc	Location of the OBU antenna phase centre
M _{centre}	Centre point between phase centres of TTA and RTA
MSS1	Monochromatic Signal Source 1
MSS2	Monochromatic Signal Source 2
n.a.	not applicable
OBU	On Board Unit
PE	Portable Equipment
PM1	Power Meter 1
ppm	parts per million (10 ⁻⁶)
PSTN	Public Switched Telephone Network
R&TTE	Radio and Telecommunications Terminal Equipment
RBW	Resolution BandWidth
RD	Receiving Device
REC	RECommendation
RF	Radio Frequency
RRxA	RSU Receiving Antenna
RSA	Receiving Substitution Antenna
RSU	Road Side Unit
RTA	Receiving Test Antenna
RTTT	Road Transport and Traffic Telematics
RTxA	RSU Transmitting Antenna
Rx	Receiver
SMS1	Signal or Message Source 1
SR	Special Report
SSB	Single Side Band
TA	Test Antenna
TD	Technical Document
TM1	Test Message 1
TS1	Test Signal 1
TS2	Test Signal 2
TSA	Transmitting Substitution Antenna
TSM	Transmitter Spectrum Mask
TTA	Transmitting Test Antenna
Tx	Transmitter
VBW	Video BandWidth
VST	Vehicle Service table
VSWR	Voltage Standing Wave Ratio
XP	Cross Polarized
XPD	Cross-Polar Discrimination

EN 12253 [2] list of down-link parameter abbreviations:

D1	Carrier frequencies
D1a	Tolerance of carrier frequencies
D2	RSU Transmitter spectrum mask
D3	OBU minimum frequency range
D4	Maximum e.i.r.p.
D5	Polarization
D5a	Cross polarization
D6	Modulation
D6a	Modulation index
D6b	Eye pattern
D7	Data coding