

**SLOVENSKI STANDARD**  
**oSIST prEN 302 065-3 V1.1.1:2013**  
**01-september-2013**

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**Elektromagnetna združljivost in zadeve v zvezi z radijskim spektrom (ERM) -  
Naprave kratkega dosega (SRD), ki uporabljajo ultra širokopasovno (UWB)  
tehnologijo za komuniciranje - Harmonizirani EN, ki zajema bistvene zahteve člena  
3.2 direktive R&TTE - 3. del: Zahteve za ultra širokopasovne (UWB) naprave za  
cestna in železniška vozila**

Electromagnetic compatibility and Radio spectrum Matters (ERM) - Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for communications purposes - Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive - Part 3: Requirements for UWB devices for road and rail vehicles

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**Ta slovenski standard je istoveten z: EN 302 065-3 Version 1.1.1**

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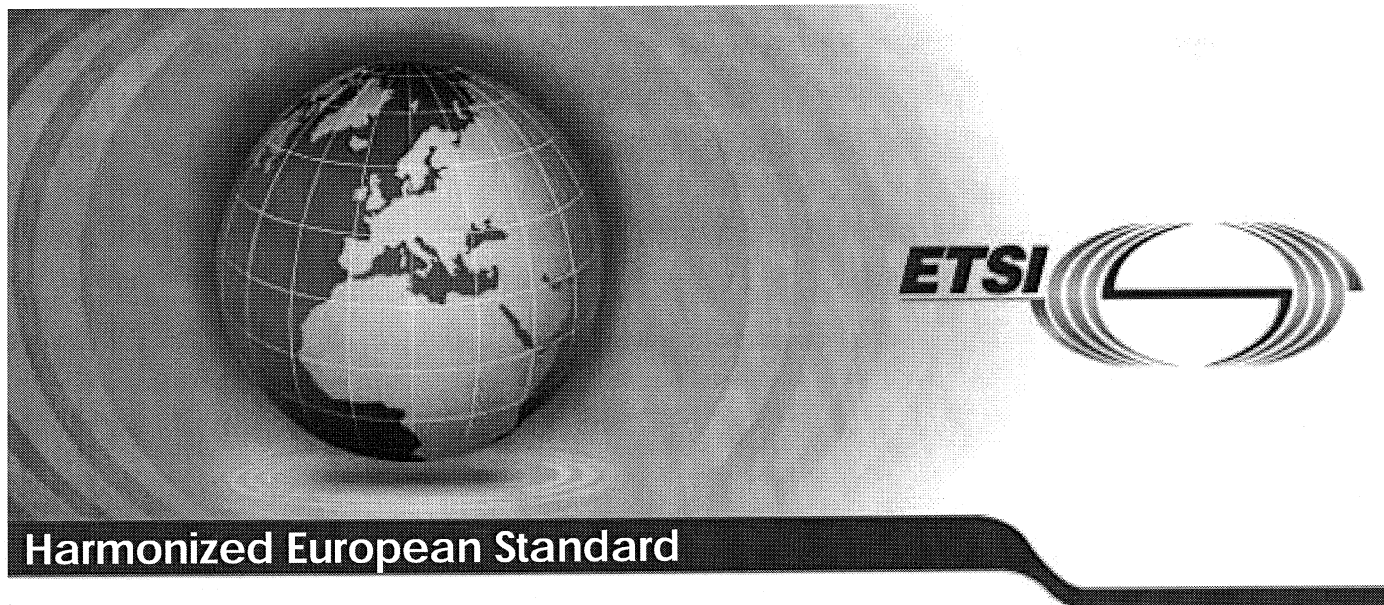
**ICS:**

33.060.99	Druga oprema za radijske komunikacije	Other equipment for radiocommunications
33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general

**oSIST prEN 302 065-3 V1.1.1:2013**      **en**



# Draft ETSI EN 302 065-3 V1.1.1 (2013-06)



Harmonized European Standard

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Short Range Devices (SRD) using  
Ultra Wide Band technology (UWB)  
for communications purposes;  
Harmonized EN covering the essential requirements  
of article 3.2 of the R&TTE Directive;  
Part 3: Requirements for UWB devices  
for road and rail vehicles**

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**Reference**

DEN/ERM-TGUWB-018

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**Keywords**

radio, regulation, SRD, testing, UWB

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Sous-Préfecture de Grasse (06) N° 7803/88

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# Contents

Intellectual Property Rights .....	5
Foreword.....	5
1 Scope .....	6
2 References .....	6
2.1 Normative references .....	6
2.2 Informative references.....	7
3 Definitions, symbols and abbreviations .....	7
3.1 Definitions.....	7
3.2 Symbols.....	8
3.3 Abbreviations .....	8
4 Technical requirements specification.....	9
4.1 Operating bandwidth .....	9
4.1.1 Definition.....	9
4.1.2 Test procedure .....	9
4.1.3 Limit .....	9
4.1.4 Measurement uncertainty.....	9
4.2 Mean power spectral density.....	9
4.2.1 Definition.....	9
4.2.2 Test procedure .....	9
4.2.3 Limit .....	10
4.2.4 Maximum allowable measurement uncertainty .....	10
4.3 Maximum value of peak power.....	10
4.3.1 Definition.....	10
4.3.2 Test procedure .....	10
4.3.3 Limit .....	10
4.3.4 Maximum allowable measurement uncertainty .....	11
4.4 Receiver spurious emissions.....	11
4.4.1 Definition.....	11
4.4.2 Test procedure .....	11
4.4.3 Limit .....	11
4.4.4 Maximum allowable measurement uncertainty .....	12
4.5 Exterior Limit.....	12
4.5.1 Definition.....	12
4.5.2 Test Procedure .....	12
4.5.3 Limit .....	13
4.5.4 Measurement uncertainty.....	13
4.6 Transmit Power Control (TPC).....	13
4.6.1 Definition.....	13
4.6.2 Test procedure .....	13
4.6.3 Limit .....	13
4.6.4 Maximum allowed measurement uncertainty .....	13
4.7 Detect And Avoid (DAA) .....	13
4.7.1 Definition.....	13
4.7.2 Test procedure .....	13
4.7.3 Limit .....	13
4.7.4 Measurement Tolerance.....	13
4.8 Low Duty Cycle (LDC).....	14
4.8.1 Definition.....	14
4.8.2 Test procedure .....	14
4.8.3 Limit .....	14
4.9 Equivalent mitigation techniques .....	14
4.9.1 Power vs. LDC Tradeoff Method .....	15
5 Test Requirements.....	15



5.1	Product information.....	15
5.2	Requirements for the test modulation.....	16
5.3	Test conditions, power supply and ambient temperatures.....	16
5.4	Choice of equipment for test suites.....	16
5.4.1	Multiple Operating bandwidths and multiband equipment.....	16
5.5	Testing of host connected equipment and plug-in radio devices.....	16
5.6	Interpretation of the measurement results.....	16
5.6.1	Measurement uncertainty is equal to or less than maximum acceptable uncertainty.....	17
5.6.2	Measurement uncertainty is greater than maximum acceptable uncertainty.....	17
5.7	Emissions.....	18
6	Test setups and procedures.....	18
6.1	Introduction.....	18
6.2	Initial Measurement steps.....	18
6.3	Radiated measurements.....	18
6.3.1	General.....	18
6.3.2	Test sites and general arrangements for measurements involving the use of radiated fields.....	18
6.3.3	Guidance on the use of a radiation test site.....	18
6.3.3.1	Range length.....	18
6.3.4	Coupling of signals.....	19
6.3.5	Standard test methods.....	19
6.3.5.1	Generic measurement method.....	19
6.3.5.1.1	Calibrated setup.....	19
6.3.5.1.2	Substitution method.....	20
6.3.5.2	Spherical scan with automatic test antenna placement.....	21
6.3.5.2.1	Calibrated setup.....	21
6.3.5.2.2	Substitution method.....	22
6.3.5.3	Spherical scan with rotating and tilting the DUT.....	22
6.3.5.3.1	Calibrated setup.....	23
6.3.5.3.2	Substitution method.....	23
6.3.5.4	Spherical scan other methods.....	24
6.3.6	Standard calibration method.....	24
6.4	Conducted measurements.....	24
7	Test procedures for essential radio test suites.....	24
7.1	General.....	24
7.2	Test Procedure.....	25
7.3	Method of measurements of the Ultra Wideband Emissions.....	26
7.4	Mean power spectral density measurements.....	26
7.5	Peak power spectral density measurements.....	26
7.6	Operating bandwidth.....	26
7.7	Receiver spurious emissions.....	26
7.8	Transmitter Power Control.....	26
7.9	Low Duty Cycle.....	26
7.10	Detect and Avoid Mechanisms.....	26
7.11	Exterior Limit.....	27
<b>Annex A (normative):</b>	<b>HS Requirements and conformance Test specifications Table (HS-RTT).....</b>	<b>28</b>
<b>Annex B (informative):</b>	<b>Measurement antenna, preamplifier, and cable specifications.....</b>	<b>30</b>
<b>Annex C (informative):</b>	<b>Surface mounted devices example mirror.....</b>	<b>31</b>
<b>Annex D (normative):</b>	<b>Device mounted inside the tire.....</b>	<b>33</b>
<b>Annex E (informative):</b>	<b>Bibliography.....</b>	<b>35</b>
History.....		36

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## Foreword

This draft Harmonized European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been produced by ETSI in response to mandate M/407 issued from the European Commission under Directive 98/34/EC [i.9] as amended by Directive 98/48/EC [i.12].

The title and reference to the present document are intended to be included in the publication in the Official Journal of the European Union of titles and references of Harmonized Standard under the Directive 1999/5/EC [i.10].

See article 5.1 of Directive 1999/5/EC [i.10] for information on presumption of conformity and Harmonized Standards or parts thereof the references of which have been published in the Official Journal of the European Union.

The requirements relevant to Directive 1999/5/EC [i.10] are summarized in Annex A.

Equipment covered by the present document operates in accordance with ECC/DEC(06)04 [i.11] "The harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands below 10,6 GHz" in road and railway vehicles.

The present document is part 3 of a multi-part deliverable covering Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for communication purposes, as identified below:

- Part 1: "Common technical requirements";
- Part 2: "Requirements for UWB location tracking";
- Part 3: "Requirements for UWB devices for road and rail vehicles".**

### 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

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# 1 Scope

The present document applies to transceivers, transmitters and receivers utilizing Ultra WideBand (UWB) technologies and used for short range communication purposes in road and rail vehicles. The present document applies to impulse, modified impulse and RF carrier based UWB communication technologies in the frequency range from 3,1 GHz to 4,8 GHz or from 6 GHz to 9 GHz.

The present document applies to road and rail applications, e.g.:

- stand-alone radio equipment with or without its own control provisions;
- plug-in radio devices intended for use with, or within, a variety of host systems, e.g. personal computers, etc.;
- plug-in radio devices intended for use within combined equipment, e.g. modems, access points, etc.;
- equipment for the communication inside and outside of road and rail vehicles;
- equipment for the localization of devices inside and outside of road and rail vehicles, e.g. hand-held devices.

The present document does not apply to fixed road infrastructure installations. For fixed rail infrastructure tracking applications see [i.5] and [i.6].

The present document applies to UWB equipment with an output connection used with a dedicated antenna or UWB equipment with an integral antenna.

The present document applies to UWB equipment conforming to ECC/DEC/(06)04 amended 9 December 2011 [i.11] for the use in road and rail vehicles.

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# 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 referenced document (including any amendments) applies.

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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] ETSI TS 102 883 (V1.1.1) (08-2012): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB); Measurement Techniques".
- [2] ETSI TS 102 754 (V1.2.1) (11-2008): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Technical characteristics of Detect-And-Avoid (DAA) mitigation techniques for SRD equipment using Ultra Wideband (UWB) technology".
- [3] ETSI TR 100 028 (all parts) (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".



## 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] ETSI TR 102 070-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide to the application of harmonized standards to multi-radio and combined radio and non-radio equipment; Part 2: Effective use of the radio frequency spectrum".
- [i.2] ETSI TR 103 086: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Conformance test procedure for the exterior limit tests in EN 302065-3 UWB applications in the ground based vehicle environment".
- [i.3] ECC Report 120 (March 2008): "ECC Report on Technical requirements for UWB DAA (Detect and avoid) devices to ensure the protection of radiolocation in the bands 3.1-3.4 GHz and 8.5-9 GHz and BWA terminals in the band 3.4 - 4.2 GHz".
- [i.4] Commission Decision 2007/131/EC of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (notified under document number C(2007) 522).
- [i.5] ETSI TR 101 538: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); UWB location tracking devices in the railroad environment".
- [i.6] ETSI TS 103 085: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB) for Location and Tracking railroad applications; RF conformance testing".
- [i.7] CEPT/ERC Recommendation 74-01: "Unwanted emissions in the spurious domain".
- [i.8] CEPT/ECC WG SE meeting minutes of meeting#62, 62nd WG SE meeting (10-14 September 2012) in Wroclaw (Poland).
- [i.9] Directive 1998/34/EC as amended by 1998/48/EC 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.  
<http://standards.etsi.org/catalog/standards/sist/c3ddd05a-0613-45e8-b2d6-7475378161/sist/302-065-3-v1-1-1-2013>
- [i.10] 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).
- [i.11] CEPT ECC/DEC/(06)04 of 24 March 2006 amended 9 December 2011: "The harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz".
- [i.12] Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**combined equipment:** any combination of non-radio equipment and a plug-in radio device that would not offer full functionality without the radio device

**dedicated antenna:** removable antenna supplied and tested with the radio equipment, designed as an indispensable part of the equipment

**detect and avoid time:** time duration between a change of the external RF environmental conditions and adaptation of the corresponding UWB operational parameters

**dwelt time:** duration of a transmission on a particular sub-channel

**Effective Radiated Power (E.R.P.):** product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction (RR 1.162)

**Equivalent Isotropically Radiated Power (E.I.R.P.):** product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain) (RR 1.161)

**gating:** transmission that is intermittent or of a low duty cycle referring to the use of burst transmissions where a transmitter is switched on and off for selected time intervals

**hopping:** spread spectrum technique whereby individual radio links are continually switched from one subchannel to another

**hopping cycle:** number of hopping positions for a full frequency hopping sequence

**host:** host equipment is any equipment which has complete user functionality when not connected to the radio equipment part and to which the radio equipment part provides additional functionality and to which connection is necessary for the radio equipment part to offer functionality

**impulse:** pulse whose width is determined by its dc step risetime and whose maximum amplitude is determined by its dc step value

**integral antenna:** permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment

**plug-in radio device:** radio equipment module intended to be used with or within host, combined or multi-radio equipment, using their control functions and power supply

**pulse:** short transient signal whose time duration is nominally the reciprocal of its  $-10$  dB bandwidth

**rf carrier:** fixed radio frequency prior to modulation

**stand-alone radio equipment:** equipment that is intended primarily as communications equipment and that is normally used on a stand-alone basis

**transmitter on time:** duration of a burst irrespective of the number of pulses contained

**transmitter off time:** time interval between two consecutive bursts when the UWB emission is kept idle

## 3.2 Symbols

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

d	distance
$\Theta$	elevation angle
f	frequency
$\lambda$	wavelength
k	coverage factor
$\Phi$	azimuth angle
T <sub>on</sub>	transmitter on time
T <sub>off</sub>	transmitter off time

## 3.3 Abbreviations

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

CEPT	European Conference of Postal and Telecommunications Administrations
DAA	Detect And Avoid
DC	Direct Current
DUT	Device Under Test
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	equivalent radiated power
EC	European Commission

ECC	European Communication Commission
EN	European Norm
FH	Frequency Hopping
LDC	Low Duty Cycle
LNA	Low Noise Amplifier
NF	Noise Figure
OE	Other Emissions
OFDM	Orthogonal Frequency Division Multiple Access
PSD	Power Spectral Density
REC	RECommendation
RF	Radio Frequency
RX	Receiver
TPC	Transmit Power Control
TR	Technical Report
TS	Technical Specification
TX	Transmitter
UWB	Ultra WideBand
VSWR	Voltage Standing Wave Ratio

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## 4 Technical requirements specification

### 4.1 Operating bandwidth

#### 4.1.1 Definition

The operating bandwidth is the -13 dBc bandwidth of the signal.

#### 4.1.2 Test procedure

This test shall either be performed using a radiated (see clauses 7.6, 6.3.1 and 6.3.2) or conducted measurement procedure (see TS 102 883 [1]).

#### 4.1.3 Limit

The operating bandwidth shall be greater than 50 MHz (at -13 dB relative to the maximum spectral power density).

#### 4.1.4 Measurement uncertainty

See TS 102 883 [1], Table 1.

### 4.2 Mean power spectral density

#### 4.2.1 Definition

The maximum mean power spectral density (specified as e.i.r.p.) of the radio device, at a particular frequency, is the average power per unit bandwidth (centred on that frequency) radiated in the direction of the maximum level under the specified conditions of measurement.

#### 4.2.2 Test procedure

This test shall be performed using the measurement procedure of clause 7.2 with the method of clause 7.4 for the frequencies as shown in Table 2.

### 4.2.3 Limit

The maximum mean power spectral density measured using the above test procedure shall not exceed the limits given in Table 1. The limit applies to the highest value found for this power (converted to an e.i.r.p.) over all frequencies, times and operating modes. It is also the highest value found over all directions, either as part of the e.i.r.p. measurement method or by using the maximum antenna gain with a conducted power measurement [1].

**Table 1: Mean power spectral density limit [i.9]**

Frequency (GHz)	Maximum value of mean power spectral density (dBm/MHz)	
	Devices with additional mitigation (e.g. DAA, LDC, TPC)	Devices without additional mitigations
$f \leq 1,6$		-90
$1,6 < f \leq 2,7$		-85
$2,7 < f \leq 3,1$		-70
$3,1 < f \leq 3,4$	$\leq -41,3$ (see notes 1 and 2)	-70
$3,4 < f \leq 3,8$	$\leq -41,3$ (see notes 1 and 2)	-80
$3,8 < f \leq 4,8$	$\leq -41,3$ (see notes 1 and 2)	-70
$4,8 < f \leq 6$		-70
$6 < f \leq 8,5$	$\leq -41,3$ (see notes 1 and 3)	-53,3
$8,5 < f \leq 9$	$\leq -41,3$ (see notes 1 and 2)	-65
$9 < f \leq 10,6$		-65
$f > 10,6$		-85

NOTE 1: With Low Duty Cycle (LDC) mitigation and the exterior limit of  $\leq -53,3$  dBm/MHz is required.  
NOTE 2: Detect And Avoid (DAA) and Transmit Power Control (TPC) is required and the exterior limit of  $-53,3$  dBm/MHz shall be fulfilled.  
NOTE 3: TPC and exterior limit  $\leq -53,3$  dBm/MHz is required.

### 4.2.4 Maximum allowable measurement uncertainty

See TS 102 883 [1], Table 1.

## 4.3 Maximum value of peak power

### 4.3.1 Definition

The peak power specified as e.i.r.p. contained within a 50 MHz bandwidth at the frequency at which the highest mean radiated power occurs, radiated in the direction of the maximum level under the specified conditions of measurement.

### 4.3.2 Test procedure

This test shall be performed using the measurement procedure of clause 7.2 with the method of clause 7.5 for the frequencies as shown in Table 2.

### 4.3.3 Limit

The maximum peak power limit measured using the above test procedure shall not exceed the limits given in Table 2. The limit applies to the highest value found for this power (converted to an e.i.r.p.) over all frequencies, times and operating modes. It is also the highest value found over all directions, either as part of the e.i.r.p. measurement method or by using the maximum antenna gain with a conducted power measurement [1].