SLOVENSKI STANDARD
SIST EN 302 065 V1.2.1:2010

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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

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

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Harmonized European Standard (Telecommunications series)

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

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Foreword

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

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC [i.2] (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 [i.3] 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").

The present document is intended to cover the provisions of article 3.2 of Directive 1999/5/EC (R&TTE Directive) [i.3].

The present document does not apply to radio equipment for which a specific Harmonized EN applies as such Harmonized EN may specify additional EN requirements relevant to the presumption of conformity under article 3.2 of the R&TTE Directive.

Technical specifications relevant to Directive 1999/5/EC [i.3] are summarised in annex A.

National transposition dates	
Date of adoption of this EN:	20 September 2010
Date of latest announcement of this EN (doa):	31 December 2010
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2011
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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. The modular structure is shown in EG 201 399 [i.1].

UWB Technologies

The present document provides a generic set of technical requirements covering many different types of UWB technologies used for short range communications. These technologies can be broken down into two groups:

1) Impulse based technologies; and

2) RF carrier based technologies.

The following clauses give a brief overview of these UWB technologies and their associated modulation techniques.

Impulse technology

Impulse derived UWB technology consists of a series of impulses created from a dc voltage step whose rise time can be modified to provide the maximum useful number of spectral emission frequencies. This derived impulse can then be suitably modified by the use of filters to locate the resulting waveform within a specific frequency spectrum range. This filter can be a standalone filter or incorporated into an antenna design to reduce emissions outside the designated frequency spectrum.

Modulation techniques include pulse positioning in time, pulse suppression and other techniques to convey information. The transmitted energy is summed at the receiver to reproduce the transmitted pulse.

This technology is suitable for direct and non-direct line of sight communications, any reflected or time delayed emissions being suppressed by the receiver input circuits.

RF carrier based technology

RF carrier based UWB technology is based upon classical radio carrier technology suitably modulated by a baseband modulating process. The modulating process must produce a bandwidth in excess of 50 MHz to be defined as UWB.

Different modulating processes are used to transmit the data information to the receiver and can consist of a series of single hopping frequencies or multi-tone carriers.

This technology can be used for both direct and non-direct line of sight communications, any reflected or time delayed emissions being suppressed by the receiver input circuits.

Test and measurement limitations

The ERA report 2006-0713 [i.9] has shown that there are practical limitations on measurements of RF radiated emissions. The minimum radiated levels that can be practically measured in the lower GHz frequency range by using a radiated measurement setup with a horn antenna and pre-amplifier are typically in the range of about -70 dBm/MHz to -75 dBm/MHz (e.i.r.p) to have sufficient confidence in the measured result (i.e. UWB signal should be at least 6 dB above the noise floor of the spectrum analyser and the measurement is performed under far-field conditions at a one meter distance).

For equipment that have dedicated detachable antennas and provide a 50 ohm antenna port for testing, conducted measurements can be made provided that suitable antenna calibrations can be provided. In the present document, test suites for conducted measurements are only provided for DAA conformance measurements. Transmitter emissions of the radio device are expected to be measured using the radiated measurement setup with the exception of UWB devices which are intended to operate at a mean power spectral density of -70 dBm/MHz or less, then a conducted test procedure can be used.

For integrated antenna equipment, previous ETSI testing standards have allowed equipment modification to provide a 50 ohm test adaptor to be added to provide the necessary test port. However, UWB integral equipment and particularly impulse based technology does not use classical radio techniques and as such is unlikely to have matched 50 ohm antenna port impedances.

The present document therefore recognizes these difficulties and provides a series of test methods suitable for the different UWB technologies.

1 Scope

The present document applies to transceivers, transmitters and receivers utilizing Ultra WideBand (UWB) technologies and used for short range communication purposes.

The present document applies to impulse, modified impulse and RF carrier based UWB communication technologies.

The present document applies to fixed (indoor only), mobile or portable 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, hand-held terminals, etc.;
- plug-in radio devices intended for use within combined equipment, e.g. cable modems, set-top boxes, access points, etc.;
- combined equipment or a combination of a plug-in radio device and a specific type of host equipment;
- equipment for use in road and rail vehicles.

NOTE 1: As per the ECC/DEC/(06)04 [i.4] and Decision 2007/131/EC [i.5] and its amendment the UWB transmitter equipment conforming to the present document is not to be installed at a fixed outdoor location, for use in flying models, aircraft and other forms of aviation.

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

These radio equipment types are capable of operating in all or part of the frequency bands given in Table 1.

Table 1: Radiocommunications frequency bands

Radiocommunications frequency bands	
Transmit	3,1 GHz to 4,8 GHz
Receive	3,1 GHz to 4,8 GHz
Transmit	6,0 GHz to 9 GHz
Receive	6,0 GHz to 9 GHz
NOTE: The UWB radio device can also operate outside of the radiocommunications frequency bands shown in the present table provided that the limits in clause 4.1.2.3, Table 2 are met.	

NOTE 2: 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 specific references, only the cited version applies. For non-specific references, the latest version of the referenced 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] 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".

[2] ANSI C63.5 (2006): "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference".

[3] ITU-R Recommendation SM 329-10 (2003): "Unwanted emissions in the spurious domain".

[4] ETSI TS 102 321 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Normalized Site Attenuation (NSA) and validation of a fully lined anechoic chamber up to 40 GHz".

[5] ETSI TS 102 754 (V1.2.1): "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".

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 EG 201 399 (V2.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".

[i.2] 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.

[i.3] 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.4] CEPT ECC/DEC/(06)04 of 24 March 2006 amended 6 July 2007 at Constanza on the harmonized conditions for devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz.

[i.5] 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.6] ITU-R Recommendation SM.1754 (2006): "Measurement techniques of ultra-wideband transmissions".

[i.7] ETSI TR 102 273 (V1.2.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".

[i.8] ETSI TR 102 070-2 (V1.1.1): "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.9] ERA Report 2006-0713: "Conducted and radiated measurements for low level UWB emissions".

[i.10] 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.11] Decision 2009/343/EC amending decision 2007/131/EC on allowing the use of radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

avoidance level: maximum amplitude to which the UWB transmit power is set for the relevant protection zone

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

default avoidance bandwidth: portion of the victim service bandwidth to be protected if no enhanced service bandwidth identification mechanisms are implemented in the DAA enabled devices

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

detection probability: probability that the DAA enabled UWB radio device reacts appropriately to a signal detection threshold crossing within the detect and avoid time

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

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

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

maximum avoidance power level: UWB transmit power assuring the equivalent protection of the victim service

minimum avoidance bandwidth: portion of the victim service bandwidth requiring protection

minimum initial channel availability check time: minimum time the UWB radio device spends searching for victim signals after power on, Parameter: $T_{avail, Time}$

narrowband: See test in clause 5.8.5.

Non-Interference mode operation (NIM): operational mode that allows the use of the radio spectrum on a non-interference basis without active mitigation techniques

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

signal detection threshold: amplitude of the victim signal which defines the transition between adjacent protection zones, Parameter: D_{thresh}

NOTE: The threshold level is defined to be the signal level at the receiver front end of the UWB DAA radio device and assuming a 0 dBi receive antenna.

signal detection threshold set: set of amplitudes of the victim signal which defines the transition between adjacent protection zones

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

victim signal: signal(s) of the service to be detected and protected by the DAA mitigation technique

wideband: emission whose occupied bandwidth is greater than the test equipment measurement bandwidth

zone model: flexible DAA concept based on the definition of different zones as defined in TS 102 754 [5]

3.2 Symbols

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

Ω	ohm
λ	wavelength
D	detection threshold
dB	decibel
dBi	gain in decibels relative to an isotropic antenna
dBm	gain in decibels relative to one milliwatt
f	frequency
f_H	highest frequency of the power envelope
f_L	lowest frequency of the power envelope
I	Isolation in dB
P	Power in dBm
R	Distance
$T_{avail\_time\_min}$	Minimum initial channel availability check time
T_{avoid}	Detect and avoid time

NOTE: Actual Detect and Avoid time of a DUT, can be negative.

T_{avoid_max}	Maximum allowed Detect and avoid time
T	time

3.3 Abbreviations

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

AC	Alternating Current
ATT	ATTenuator/ATTenuation
BPSK	Binary Phase Shift Keying
BWA	Broadband Wireless Access
CEPT	European Conference of Postal and Telecommunications Administrations
CON	Conformance test results
DAA	Detect And Avoid
dc	direct current
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
ECC	Electronic Communications Committee
EIRP	Equivalent Isotropically Radiated Power
EUT	Equipment Unter Test
FDD	Frequency Division Duplex
FH	Frequency Hopping

FMCW	Frequency Modulated Continuous Wave
FSK	Frequency Shift Keying
HS	Harmonized Standard
ICS	Implementation Conformance Statement
LDC	Low Duty Cycle
LFM	Linear Frequency Modulation
LNA	Low Noise Amplifier
NIM	Non Interference Mode
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
PPB	Pulse Per Burst
PRF	Pulse Repetition Frequency
R&TTE	Radio and Telecommunications Terminal Equipment
RBW	Resolution BandWidth
RF	Radio Frequency
RMS	Root Mean Square
RR	Radio Regulations
Rx	Receiver
SNR	Signal to Noise Ratio
SRD	Short Range Device
TDD	Time Division Duplex
TPC	Transmit Power Control
Tx	Transmitter
UWB	Ultra WideBand
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specification

4.1 Technical requirements

4.1.1 Operating bandwidth

4.1.1.1 Definition

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a percentage of 5 % of the total mean power of a given emission.

For the purposes of the present document the measurements are made at the -13 dB points.

4.1.1.2 Test procedure

This test shall be performed using a radiated test procedure (see clause 5.4.4 and annex B).

For UWB devices which are intended to operate at a mean power spectral density of -70 dBm/MHz or less, the test can be performed using a conducted test procedure.

4.1.1.3 Limit

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

4.1.1.4 Measurement uncertainty

See Table 10.

4.1.2 Maximum value of mean power spectral density

4.1.2.1 Definition

The maximum mean power spectral density (specified as e.i.r.p.) of the radio device under test, 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.

4.1.2.2 Test procedure

This test shall be performed using a radiated test procedure (see clause 5.8.2) for the frequencies as shown in Table 2.

This test shall be repeated at the frequencies as shown in Table 2 including the frequency band edges at 1,6 GHz, 2,7 GHz, 3,1 GHz, 3,4 GHz, 3,8 GHz, 4,8 GHz, 6,0 GHz and 8,5 GHz, 9 GHz and 10,6 GHz as shown in Table 2.

4.1.2.3 Limit

The maximum mean power spectral density measured using the above test procedure shall not exceed the limits given in Table 2.

Table 2: Maximum value of mean power spectral density limit

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

NOTE 1: When DAA is implemented, equipment shall implement the whole frequency range from 3,1 GHz to 4,8 GHz. Radio devices shall be capable of selecting an operating channel anywhere within the band 3,1 GHz to 4,8 GHz.
NOTE 2: LDC or DAA is required (see clause 4.1.6 or 4.1.7).
NOTE 3: In case of radio devices installed in road and rail vehicles, operation is subject to the implementation of LDC or combination of TPC and DAA. TPC shall have a range of 12 dB with respect to the maximum value of mean power spectral density. If only DAA is implemented then the following applies:
- 3,1 GHz to 4,8 GHz ≤ -53,3 dBm/MHz.

NOTE 4: In case of radio devices installed in road and rail vehicles, operation is subject to the implementation of LDC or Transmit Power Control (TPC). TPC shall have a range of 12 dB with respect to the maximum value of mean power spectral density. If TPC or LDC is not implemented then the following applies:
- 6 GHz to 8,5 GHz ≤ -53,3 dBm/MHz.

NOTE 5: If DAA is not implemented then the following applies:
- 8,5 GHz to 9 GHz ≤ -65 dBm/MHz.

NOTE 6: In case of radio devices installed in road and rail vehicles, operation is subject to the implementation of either DAA and LDC or DAA and TPC. TPC shall have a range of 12 dB with respect to the maximum value of mean power spectral density. If only DAA is implemented then the following applies: 8,5 GHz to 9 GHz ≤ -53,3 dBm/MHz.