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## Foreword

This Harmonized European Standard (EN) 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 mandate M/407 issued from the European Commission under Directive 98/34/EC [i.14] as amended by Directive 98/48/EC [i.16].

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.15].

See article 5.1 of Directive 1999/5/EC [i.15] 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.15] are summarized in Annex A.

The present document is part 1 of a multi-part deliverable covering Short Range Devices (SRD) using Ultra Wide Band technology (UWB), as identified below:

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

### National transposition dates

Date of adoption of this EN:	8 April 2014
Date of latest announcement of this EN (doa):	31 July 2014
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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 [i.15]. 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:

- Impulse based technologies; and
- 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.

### 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 should 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.

# 1 Scope

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

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.

NOTE: As per the ECC/DEC/(06)04 [i.2], CEPT report 45 [i.17] and Commission Decision 2007/131/EC [i.8] 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.

Equipment covered by the present document operates in accordance with ECC/DEC(06)04 [i.2] "The harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz".

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

**Table 1: Operating frequency bands**

Operating 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 operating frequency bands shown in the present table provided that the limits in clause 4.2.3, Table 2 are met.

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 [i.15].

## 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] Void.
- [2] 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".
- [3] ETSI TS 102 754 (V1.3.1) (03-2013): "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".
- [4] ETSI TR 100 028 (V1.4.1) (all parts) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [5] ETSI EN 301 489-33 (V1.1.1) (02-2009): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 33: Specific conditions for Ultra Wide Band (UWB) communications devices".

### 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] 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.3] Void.
- [i.4] Void.
- [i.5] 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.6] Void.
- [i.7] 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.8] 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).

NOTE: This EC Decision is currently under revision based on CEPT report 45 [i.17] and amended ECC/DEC(06)04 [i.2]. The new EC/DEC revision is expected within 2014.

[i.9] Void.

[i.10] Void.

[i.11] CEPT/ERC Recommendation 74-01: "Unwanted emissions in the spurious domain".

[i.12] ETSI TS 102 902 (02-2011): "Electromagnetic compatibility and radio spectrum matters (ERM); Methods, parameters and test procedures for cognitive interference mitigation towards ER-GSM for use by UHF RFID using Detect-And-Avoid (DAA) or other similar techniques".

[i.13] Void.

[i.14] Directive 98/34/EC of 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.15] 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.16] 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.

[i.17] CEPT report 45: "Report from CEPT to the European Commission in response to the Fifth Mandate to CEPT on ultra-wideband technology to clarify the technical parameters in view of a potential update of Commission Decision 2007/131/EC"; Report approved on 21 June 2013 by the ECC.

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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:

**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

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

**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

**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:** equipment to be used in a non-channelized continuous frequency band with an occupied bandwidth of equal or less than 25 kHz, or equipment to be used in a channelized frequency band with a channel spacing of equal or less than 25 kHz

**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

**transmitter on time ( $T_{on}$ ):** duration of a burst irrespective of the number of pulses contained

**transmitter off time ( $T_{off}$ ):** time interval between two consecutive bursts when the UWB emission is kept idle

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

**zone model:** flexible DAA concept based on the definition of different zones as defined in TS 102 754 [3]

## 3.2 Symbols

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

$\alpha$	elevation angle
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
EUT	Equipment Under Test
LDC	Low Duty Cycle
LNA	Low Noise Amplifier
NF	Noise Figure
REC	RECOMMENDATION
RF	Radio Frequency
RX	Receiver
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 of operating bandwidth for test procedure

The operating bandwidth is the -13 dBc bandwidth of intended UWB signal transmitted by the equipment.

#### 4.1.2 Test procedure

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

This test shall be performed using a radiated test procedure as specified in clause 7.5.

For UWB devices which are intended to operate at a mean power spectral density of -65 dBm/MHz or less, the test shall be performed using a conducted test procedure as given in TS 102 883 [2], clause 6.