Draft ETSI EN 302 065-2 V1.1.1 (2013-06)

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 2: Requirements for UWB location tracking

Reference
DEN/ERM-TGUWB-017

Keywords
radio, regulation, SRD, testing, UWB

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

Contents

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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.2] 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.3].

See article 5.1 of Directive 1999/5/EC [i.3] 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.3] are summarized in annex A.

Equipment covered by the present document operates in accordance with ECC/DEC(06)04 [i.4] "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 2 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

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.3]. 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 location tracking purposes. These UWB 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. In both cases, measurements of the UWB signals can be used to determine location-related properties of the signal, such as time-of-arrival, angle-of-arrival and signal strength, which can be used in turn to ascertain the location of a transmitter relative to the receiver.

- **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 data information to the receiver and can consist of a series of single hopping frequencies or multi-tone carriers.

1 Scope

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

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

The present document applies to fixed, 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.

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 covers three different types of location tracking system, which may use either of the UWB technologies listed previously:

- **LT1 systems:** These systems, operating in the 6 GHz to 9 GHz region (see [i.7]), are intended for general location tracking of people and objects. They operate on an unlicensed basis. The transmitting terminals in these systems are mobile (indoors or outdoors), or fixed (indoors only). Fixed outdoor LT1 transmitters are not permitted. Typically, LT1 transmitters are mobile location tracking tags which are attached to people or objects, and tags are tracked using a fixed receiver infrastructure to only receive the UWB emission emitted by the tags, [i.1].
- **LT2 systems:** These systems, operating in the 3,1 GHz to 4,8 GHz region (see [i.8]), are intended for person and object tracking and industrial applications at well-defined locations. The transmitting terminals in these systems may be located indoors or outdoors, and may be fixed or mobile. They operate at fixed sites and may be subject to registration and authorization, provided local coordination with possible interference victims has been performed, [i.10] and [i.11].
- **LAES systems:** These systems, operating in the 3,1 GHz to 4,8 GHz region (see [i.9]), are intended for tracking staff belonging to the fire and other emergency services, who need to work in dangerous situations. Being able to track such people, even when deep inside a building, provides an important enhancement to command and control and to their personal safety. Typically, an LAES system is deployed temporarily at the scene of a fire or other emergency in a building. Licences may be required for user organization, [i.10] and [i.11].

Some individual location tracking devices may be able to operate within different kinds of location tracking systems, and therefore may meet (in different modes) the requirements of any or all of LT1, LT2 and LAES.

The present document does not cover UWB transmitters whose authorization to operate depends solely on the tests set out in the present document and which are installed or used in flying models, aircraft and other forms of aviation. Furthermore, it does not cover LT1 UWB transmitters that are operated on board a road or rail vehicle running on a public network or highway.

A summary of the radio bands in which these radio equipment types are capable of operating is given in table 1.

Table 1: Operating frequency bands

Device type	Mode	Radiocommunications frequency bands
LT1	Transmit	6,0 GHz to 9 GHz
	Receive	6,0 GHz to 9 GHz
LT2	Transmit	3,1 GHz to 4,8 GHz
	Receive	3,1 GHz to 4,8 GHz
LAES	Transmit	3,1 GHz to 4,8 GHz
	Receive	3,1 GHz to 4,8 GHz

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 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".

[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".

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 9 December 2011: "The harmonised 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] 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.7] 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.

[i.8] ECC Recommendation (11)09 on UWB Location Tracking Systems Type 2 (LT2), October 2011.

[i.9] ECC Recommendation (11)10 on Location Tracking Application for Emergency and Disaster Situations, October 2011.

[i.10] ECC Report 167 (May, 2011): "The Practical Implementation of Registration/Coordination Mechanism for UWB LT2 (Location Tracking Type 2) Systems".

[i.11] ECC Report 170 (October, 2011): "ECC Report on Specific UWB Applications in the Bands 3.4 - 4.8 GHz and 6 - 8.5 GHz Location Tracking Applications for Emergency Services (LAES), Location Tracking Applications Type 2 (LT2) and Location Tracking and Sensor Applications for Automotive and Transportation Environments (LTA)".

[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.

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

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)

fixed-mounted station: station which is fixed mounted and which is not intended to be operated while in motion; however, it behaves otherwise in the system like a mobile station

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

impulsive UWB signal: radiated, short transient Ultra Wideband signal whose occupied bandwidth is defined by its time duration

integral antenna: antenna designed to be connected to the equipment without the use of a standard connector and considered to be part of the equipment

NOTE: An integral antenna may be fitted internally or externally to 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

Mobile Station (MS): station intended to be used while in motion or during halts at unspecified points

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

portable station: mobile station that is portable but cannot comfortably be carried around by a person due to weight and/or size or having relatively high power consumption

provider: manufacturer or his authorized representative or the person responsible for placing on the market

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

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

rf carrier: fixed radio frequency prior to modulation

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 location tracking equipment and that is normally used on a stand-alone basis

Ultra WideBand (UWB): 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, which may overlap several frequency bands allocated to radiocommunication services

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

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	time

3.3 Abbreviations

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

BWA	Broadband Wireless Access
CEPT	European Conference of Postal and Telecommunications Administrations
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
FH	Frequency Hopping
HS	Harmonized Standard
LAES	Location tracking application for emergency and disaster situations
LDC	Low Duty Cycle
NIM	Non Interference Mode
OE	Other Emissions
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
SRD	Short Range Device
Tx	Transmitter
UWB	Ultra WideBand

4 Technical requirements specification

4.1 Technical requirements

4.1.1 Mean power spectral density

4.1.1.1 Definition

The maximum mean power spectral density to be measured is defined in TS 102 883 [2].

4.1.1.2 Test procedure

This test shall be performed according to TS 102 883 [2].

This test shall be repeated at the frequencies as shown in table 2, 3 or 4 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.

4.1.1.3 Limit

The maximum mean power spectral density measured using the above test procedure shall not exceed the limits given in table 2 (for LT1 equipment [i.7]), table 3 (for LAES equipment [i.9]), or table 4 (for LT2 equipment [i.8]).

Table 2: Maximum value of mean power spectral density limit for LT1 [i.7]

Frequency (GHz)	Maximum value of mean power spectral density (dBm/MHz)	
	LT1 transmitters	
	Without DAA	With DAA
f ≤ 1,6	-90	
1,6 < f ≤ 2,7	-85	
2,7 < f ≤ 3,1	-70	
3,1 < f ≤ 3,4	-70	
3,4 < f ≤ 3,8	-80	
3,8 < f ≤ 4,8	-70	
4,8 < f ≤ 6	-70	
6 < f ≤ 8,5	-41,3	
8,5 < f ≤ 9	-65	-41,3
9 < f ≤ 10,6	-65	
f > 10,6	-85	

Table 3: Maximum value of mean power spectral density limit (for LAES) [i.9]

Frequency (GHz)	Maximum value of mean power spectral density (dBm/MHz)	
	LAES transmitters	
	Without DAA	With DAA
f ≤ 1,6	-90	
1,6 < f ≤ 2,7	-85	
2,7 < f ≤ 3,1	-70	
3,1 < f ≤ 3,4	-70	-41,3 (see note)
3,4 < f ≤ 4,2	-21,3 (see note)	
4,2 < f ≤ 4,8	-41,3 (see note)	
4,8 < f ≤ 6	-70	
6 < f ≤ 10,6	-70	
f > 10,6	-85	
NOTE: A maximum duty cycle of 5 % per transmitter per second also applies.		

Table 4: Maximum value of mean power spectral density limit for LT2 [i.8]

Frequency (GHz)	Maximum value of mean power spectral density (dBm/MHz)			
	Fixed outdoor LT2 transmitters		Mobile and fixed indoor LT2 transmitters	
	Without DAA	With DAA	Without DAA	With DAA
f ≤ 1,6	-90			
1,6 < f ≤ 2,7	-85			
2,7 < f ≤ 3,1	-70			
3,1 < f ≤ 3,4	-70	-41,3 (see note 1)	-70	-41,3 (see note 1)
3,4 < f ≤ 3,8	-41,3 (see note 1)		-41,3 (see notes 1 and 2)	
3,8 < f ≤ 4,8	-41,3 (see notes 1 and 3)		-41,3 (see notes 1 and 2)	
4,8 < f ≤ 6	-70			
6 < f ≤ 10,6	-70			
f > 10,6	-85			
NOTE 1: A maximum duty cycle of 5 % per transmitter per second and a maximum Ton = 25 ms also apply. NOTE 2: The duty cycle should also be limited to 1,5 % per transmitter per minute, or equipment should implement an alternative mitigation technique that provides at least equivalent protection. NOTE 3: The maximum mean e.i.r.p. spectral density in the band 4,2 GHz to 4,4 GHz for emissions that appear 30° or greater above the horizontal plane should be less than -47,3 dBm/MHz, see clause 4.1.1.4 [i.11].				

4.1.1.4 Additional measurement for LT2 fixed outdoor terminals

Terminals for LT2 equipment [i.8] shall be declared by the manufacturer to be for either fixed or mobile use. A terminal declared to be for fixed use shall have a clearly identified vertical axis and upward direction, and shall be supplied by the manufacturer to users with instructions that it be installed with this axis vertical. Such fixed terminals shall be subjected to the following additional test.

Within the RF range 4,2 GHz to 4,4 GHz the maximum mean EIRP spectral density in any direction within 30 degrees of the identified vertical axis upwards shall be -47,3 dBm/MHz or less, measured in the same way as for the limits in clause 4.1.1.2.

4.1.1.5 Additional site registration requirements for LT2 and LAES terminals

Additional site registration requirements are set out for LT2 terminals in [i.8] and [i.10], and for LAES terminals in [i.9] and [i.10].

4.1.2 Maximum value of peak power

4.1.2.1 Definition

The maximum value of peak power to be measured is defined in TS 102 883 [2].

4.1.2.2 Test procedure

This test shall be performed according to TS 102 883 [2].

4.1.2.3 Limit

The maximum peak power limit measured using the above test procedure shall not exceed the limits given in table 5 (for LT1 equipment [i.7]), table 6 (for LAES equipment [i.9]), or table 7 (for LT2 equipment [i.8]).

Table 5: Maximum peak power limit for LT1 [i.7]

Frequency (GHz)	Maximum value of peak power spectral density (dBm)	
	LT1 transmitters	
	Without DAA	With DAA
f ≤ 1,6	-50	
1,6 < f ≤ 2,7	-45	
2,7 < f ≤ 3,1	-36	
3,1 < f ≤ 3,4	-36	
3,4 < f ≤ 3,8	-40	
3,8 < f ≤ 4,8	-30	
4,8 < f ≤ 6	-30	
6 < f ≤ 8,5	0	
8,5 < f ≤ 9	-25	0
9 < f ≤ 10,6	-25	
f > 10,6	-45	

Table 6: Maximum peak power limit for LAES [i.9]

Frequency (GHz)	Maximum value of peak power spectral density (dBm)	
	LAES transmitters	
	Without DAA	With DAA
f ≤ 1,6	-50	
1,6 < f ≤ 2,7	-45	
2,7 < f ≤ 3,1	-36	
3,1 < f ≤ 3,4	-36	0 (see note)
3,4 < f ≤ 4,2	20 (see note)	
4,2 < f ≤ 4,8	0 (see note)	
4,8 < f ≤ 6	-30	
6 < f ≤ 10,6	-30	
f > 10,6	-45	
NOTE: A maximum duty cycle of 5 % per transmitter per second also applies.		

Table 7: Maximum peak power limit for LT2 [i.8]

Frequency (GHz)	Maximum value of mean power spectral density (dBm/MHz)			
	Fixed outdoor LT2 transmitters		Mobile and fixed indoor LT2 transmitters	
	Without DAA	With DAA	Without DAA	With DAA
f ≤ 1,6	-50			
1,6 < f ≤ 2,7	-45			
2,7 < f ≤ 3,1	-36			
3,1 < f ≤ 3,4	-36	0 (see note 1)	-36	0 (see note 1)
3,4 < f ≤ 3,8	0 (see note 1)		0 (see notes 1 and 2)	
3,8 < f ≤ 4,8	0 (see notes 1 and 3)		0 (see notes 1 and 2)	
4,8 < f ≤ 6	-30			
6 < f ≤ 10,6	-30			
f > 10,6	-45			

NOTE 1: A maximum duty cycle of 5 % per transmitter per second and a maximum Ton = 25 ms also apply.
NOTE 2: The duty cycle should also be limited to 1,5 % per transmitter per minute, or equipment should implement an alternative mitigation technique that provides at least equivalent protection.
NOTE 3: The maximum mean e.i.r.p. spectral density in the band 4,2 GHz to 4,4 GHz for emissions that appear 30° or greater above the horizontal plane should be less than -47,3 dBm/MHz, see clause 4.1.1.4 [i.11].

4.1.3 Other Emissions

4.1.3.1 Definition

The definition of Other Emissions is given in TS 102 883 [2].

4.1.3.2 Test procedure

The test procedures according to TS 102 883 [2] shall be used.

4.1.3.3 Limit

The limits for other emissions are given in TS 102 883 [2].

4.1.4 Receiver spurious emissions

4.1.4.1 Definition

The definition of receiver spurious emissions is given in TS 102 883 [2]. Receiver spurious emission testing applies only when the equipment can operate in a receive-only mode.

4.1.4.2 Test procedure

The radiated test procedures according to TS 102 883 [2] shall be used.

4.1.4.3 Limit

The limits for receiver spurious emissions are given in TS 102 883 [2].

4.1.5 Detect-And-Avoid (DAA)

4.1.5.1 Introduction

UWB radio devices can be equipped with Detect and Avoid capability to prevent interference to other systems operating in the range 3,1 GHz to 3,4 GHz (LT2 [i.7], [i.8] and LAES [i.9] systems) and 8,5 GHz to 9 GHz (LT1 [i.7] systems).

The frequency ranges and operational modes applicable to DAA are defined in TS 102 883 [2] and TS 102 754 [1].

4.1.5.2 Test procedure

This test shall be performed according to TS 102 883 [2] and TS 102 754 [1].

4.1.5.3 Limit

The DAA test criteria are expressed in TS 102 883 [2] and TS 102 754 [1].

4.1.6 Low Duty Cycle (LDC)

4.1.6.1 Definitions

Duty cycle limits are indicated by a fraction or a percentage, a time interval, and in some cases a maximum of Ton.

The limit always applies to a single terminal or device.

See [i.4], annex 2 for further information.

4.1.6.2 Test procedure

The manufacturer shall provide sufficient information for determining compliance with the Ton and duty cycle limits that apply to the equipment.

4.1.6.3 Limits

The Ton and duty cycle of the equipment shall not exceed the limits in table 8 (for LAES [i.9]) or table 9 (for LT2 [i.8]) unless the equipment implements an equivalent mitigation technique (see clause 4.1.7):

Table 8: Duty cycle and Ton limits for LAES [i.9] equipment

Parameter	Limit
Maximum Duty cycle per second	5 %

Table 9: Duty cycle and Ton limits for LT2 [i.8] equipment

Parameter	Limit
Maximum Duty cycle per second	5 %
Maximum Duty cycle per minute	1,5 %
Maximum Ton duration	25 ms

4.1.7 Equivalent mitigation techniques

Other mitigation techniques and mitigation factors can be taken into account for the calculation of the maximum allowed TX power of a UWB radio device as long as the reached mitigation factors are equivalent or higher than the mitigation factors reached using the presented techniques which have been accepted by the CEPT/ECC (e.g. ECC report 120 [i.6]). Examples for additional mitigation factors could be the deployment of the radio device on a vehicle, which operates only in a restricted indoor area with higher wall attenuation, shielding or the deployment and installation of the UWB system in a controlled manner. The additional mitigation factors need to be weighed against the specific services to be protected and a similar approach has to be taken like e.g. in ECC report 120 [i.6].

The manufacturer shall provide sufficient information for determining compliance with the transmission emission limits in tables 2, 3 and 4 when using equivalent mitigation techniques.

NOTE: Regulations in the EC decision 2007/131/EC [i.5] and its amendment allow for other equivalent mitigation techniques to be used across all frequency bands, where these offer at least equivalent protection to that provided by the limits in the decision.

5 Essential radio test suites

5.1 Product information

The product information specified in TS 102 883 [2], clause 5.2 shall be provided by the manufacturer.

5.2 Requirements for the test modulation

The test modulation specified in TS 102 883 [2], clause 5.3 shall be used during the testing.

5.3 Test conditions, power supply and ambient temperatures

The test conditions, power supply and ambient temperatures during the testing shall be as specified in TS 102 883 [2], clause 5.4.

5.4 Choice of equipment for test suites

The choice of equipment for test suites shall be as specified in TS 102 883 [2], clause 5.5.

5.5 Testing of host connected equipment and plug-in radio devices

Testing of host conducted equipment and plug-in radio devices shall be performed as specified in TS 102 883 [2], clause 5.6.

5.6 Interpretation of the measurement results

Interpretation of measurement results shall be as specified in TS 102 883 [2], clause 5.7.

5.7 Other emissions

Treatment of other emissions shall be as specified in TS 102 883 [2], clauses 7.2.5 and 7.2.6.

6 Test procedures for essential radio test suites

Test procedures for essential radio test suites shall be performed as specified in TS 102 883 [2], clause 7.3.

6.1 General

First the complete signal device shall be measured for:

- the maximum mean power spectral density (e.i.r.p.);
- the maximum peak power (e.i.r.p.);
- Other emissions (OE);
- the receiver spurious emissions;
- Low Duty Cycle (LDC);

- Detect and avoid.

6.1.1 Maximum mean power spectral density

Maximum mean power spectral density test procedures for essential radio test suites shall be performed as specified in TS 102 883 [2], clause 7.3.

6.1.2 Maximum peak power

Maximum peak power procedures for essential radio test suites shall be performed as specified in TS 102 883 [2], clause 7.4.4.

6.1.3 Other emissions

Measurements of Other Emissions, if necessary, shall be performed as specified in the "Emissions" clause of TS 102 883 [2], clause 7.3.

6.1.4 Receiver spurious emissions

Measurements of receiver spurious emissions shall be performed as specified in the "Receiver spurious emissions" clause of TS 102 883 [2], clause 7.4.5.

6.1.5 Low Duty Cycle

See clause 4.1.6.

6.1.6 Detect-and-Avoid (DAA)

DAA testing shall be performed as specified in TS 102 883 [2], clause 7.4.7 and TS 102 754 [1]. The following test parameter values shall be used:

$$m = 10$$

$$n = 5$$

Annex A (normative): HS Requirements and conformance Test specifications Table (HS-RTT)

The HS Requirements and conformance Test specifications Table (HS-RTT) in table A.1 serves a number of purposes, as follows:

- it provides a statement of all the requirements in words and by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it provides a statement of all the test procedures corresponding to those requirements by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it qualifies each requirement to be either:
  - Unconditional: meaning that the requirement applies in all circumstances; or
  - Conditional: meaning that the requirement is dependent on the manufacturer having chosen to support optional functionality defined within the schedule.
- in the case of Conditional requirements, it associates the requirement with the particular optional service or functionality;
- it qualifies each test procedure to be either:
  - Essential: meaning that it is included with the Essential Radio Test Suite and therefore the requirement shall be demonstrated to be met in accordance with the referenced procedures;
  - Other: meaning that the test procedure is illustrative but other means of demonstrating compliance with the requirement are permitted.

Table A.1: HS Requirements and conformance Test specifications Table (HS-RTT)

Harmonized Standard EN 302 065-2 The following requirements and test specifications are relevant to the presumption of conformity under the article 3.2 of the R&TTE Directive [i.3]						
Requirement			**Requirement Conditionality**		**Test specification**	
No	**Description**	**Reference: clause No**	**U/C**	**Condition**	**E/O**	**Reference: clause No**
1	Mean power spectral density	4.1.1	U		E	6.1.1
2	Maximum value of peak power	4.1.2	U		E	6.1.2
3	Other emissions	4.1.3	C	Applies only to equipment whose emissions in transmit mode do not meet the appropriate UWB regulations	E	6.1.3
4	Receiver spurious emissions	4.1.4	C	Applies only to equipment that can be operated in a receive-only mode	E	6.1.4
5	Detect-and-avoid	4.1.5	C	Applies only to LT2 and LAES equipment operating in the frequency band 3,1 GHz to 3,4 GHz and having DAA, and equipment operating in the frequency band 8,5 GHz to 9 GHz and having DAA	E	6.1.6

Harmonized Standard EN 302 065-2 The following requirements and test specifications are relevant to the presumption of conformity under the article 3.2 of the R&TTE Directive [i.3]						
Requirement			**Requirement Conditionality**		**Test specification**	
No	**Description**	**Reference: clause No**	**U/C**	**Condition**	**E/O**	**Reference: clause No**
6	Low Duty Cycle	4.1.6	C	Applies only to LT2 and LAES equipment with LDC implemented in the frequency range: 3,1 GHz to 4,8 GHz	O	6.1.5
7	Equivalent Mitigation Techniques	4.1.7	C	Applies only to equipment using equivalent mitigation techniques	X	

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement or its test specification.

Description A textual reference to the requirement.

Clause Number Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is to be *unconditionally* applicable (U) or is *conditional* upon the manufacturers claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement shall or shall not be applicable for a technical requirement which is classified "conditional".

Test Specification:

E/O Indicates whether the test specification forms part of the Essential Radio Test Suite (E) or whether it is one of the Other Test Suite (O).

NOTE: All tests whether "E" or "O" are relevant to the requirements. Rows designated "E" collectively make up the Essential Radio Test Suite; those designated "O" make up the Other Test Suite; for those designated "X" there is no test specified corresponding to the requirement. The completion of all tests classified "E" as specified with satisfactory outcomes is a necessary condition for a presumption of conformity. Compliance with requirements associated with tests classified "O" or "X" is a necessary condition for presumption of conformity, although conformance with the requirement may be claimed by an equivalent test or by manufacturer's assertion supported by appropriate entries in the technical construction file.

Clause Number Identification of clause(s) defining the test specification in the present document unless another document is referenced explicitly. Where no test is specified (that is, where the previous field is "X") this field remains blank.

Annex B (informative): Bibliography

- CEPT ECC/DEC/(06)12 of 1 December 2006 amended Cordoba, 31 October 2008 on supplementary regulatory provisions to Decision ECC/DEC/(06)04 for UWB devices using mitigation techniques.
- CENELEC EN 55022 (2006): "Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement".
- Ketterling, H-P: "Verification of the performance of fully and semi-anechoic chambers for radiation measurements and susceptibility/immunity testing", 1991, Leatherhead/Surrey.
- ECC TG3#18-18R0: "Flexible DAA mechanism based on "isolation criteria" between victim service and UWB devices", ECC TG3 Meeting 18, Mainz, March 2007.
- ICT project WALTER: "Wireless alliances for testing experiment and research".

NOTE: Available at http://www.walter-uwb.eu/.

- Commission Decision 2008/411/EC of 21 May 2008 on the harmonisation of the 3 400-3 800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community.
- ETSI EN 301 489-33 (V1.1.1): "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".
- Recommendation ITU-R SM.1754 (2006): "Measurement techniques of ultra-wideband transmissions".
- 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".
- 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".
- ERA Report 2006-0713: "Conducted and radiated measurements for low level UWB emissions".
- ETSI EN 302 065-1 (V1.3.1): "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 1: Common technical requirements".

History

Document history			
V1.1.1	June 2013	EN Approval Procedure	AP 20131015: 2013-06-17 to 2013-10-15