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HARMONISED EUROPEAN STANDARD

**Short Range Devices (SRD) using
Ultra Wide Band technology (UWB);
Harmonised Standard covering the essential requirements
of article 3.2 of the Directive 2014/53/EU;
Part 1: Requirements for Generic UWB applications**

Reference

REN/ERM-TGUWB-128

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Foreword

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

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.10] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

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 ground based vehicular applications";
- Part 4: "Material Sensing devices using UWB technology below 10,6 GHz".

National transposition dates	
Date of adoption of this EN:	5 July 2016
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Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 April 2017
Date of withdrawal of any conflicting National Standard (dow):	30 April 2018

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

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.

As per the ECC/DEC/(06)04 [i.2] and Decision 2007/131/EC [i.4] and its amendments [i.5], [i.6], 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: Permitted ranges of operation

Permitted range of operation (see note 1)	
Transmit	30 MHz to 10,6 GHz
Receive	30 MHz to 10,6 GHz
Intended ranges of operation (preferred range of operating bandwidth), see note 2	
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 1: Limits in table 2 clause 4.3.2 and table 3 clause 4.3.3 are to be met.	
NOTE 2: This is the preferred range for the operating bandwidth, as defined in clause 4.3.1.	

The present document does not apply to radio equipment for which a specific harmonised standard applies as such harmonised standards may specify additional EN requirements relevant to the presumption of conformity under article 3.2 of the Directive 2014/53/EU [i.1].

2 References

2.1 Normative 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.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI EN 303 883 (V1.1.1) (09-2016): "Short Range Devices (SRD) using Ultra Wide Band (UWB); Measurement Techniques".
- [2] 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".
- [3] Void.
- [4] ETSI TS 103 361 (V1.1.1) (03-2016): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Technical requirements, parameters and measurement procedures under the Directive 2014/53/EU Support to update of UWB related harmonized standards".

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] Directive 2014/53/EU of the European Parliament and of the council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing directive 1999/5/EC.
- [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] 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] Commission Decision 2009/343/EC of 21 April 2009 amending Decision 2007/131/EC 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(2009) 2787).
- [i.6] Commission Decision 2014/702/EU of 7 October 2014 amending Decision 2007/131/EC on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (notified under document C(2014) 7083).
- [i.7] CEPT/ERC Recommendation 74-01: "Unwanted emissions in the spurious domain".

- [i.8] 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.
- [i.9] Void.
- [i.10] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 303 883 [1] and the following apply:

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

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

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 303 883 [1] and the following apply:

α	elevation angle
d	distance
k	coverage factor

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 303 883 [1] and the following apply:

CEPT	European Conference of Postal and Telecommunications Administrations
NF	Noise Figure
TR	Technical Report
TS	Technical Specification

4 Technical requirements specifications

4.1 Environmental conditions

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile. The normal test conditions are defined in clause 5.4.3 of ETSI EN 303 883 [1].

4.2 General

UWB devices in the scope of the present document can operate in a broad permitted range of frequencies from 30 MHz to 10,6 GHz, as defined in table 1 of the present document. The intended range of operation gives the preferred range of operating bandwidth for the UWB operation based on the allowed spectrum mask with increase permitted emission levels in the intended range of operation.

In order to clearly identify the required limits and thus measurement procedures it is essential to define the operating bandwidth of the UWB DUT, the operating bandwidth of the UWB DUT test shall be the -10 dBc bandwidth of the intended UWB signal under normal operational conditions as defined in ETSI EN 303 883 [1], clause 5.4.3.

A single UWB device can have more than one operating bandwidth. The basic concept is described in figure 1.

Here two separate operating bandwidths are depicted, one with a UWB operating bandwidth in the lower frequency range (< 6 GHz) and one in the upper frequency range (> 6 GHz). All UWB related emissions shall be measured in the identified operating bandwidth(s) of the UWB device under test. The mitigation techniques are only valid in the operating bandwidth(s).

The RX interference signal handling is focused in the operating bandwidth and some clearly identified frequencies outside the operating bandwidth(s), see clause 4.4.3.

TE: Total emission including UWB emission (mean power spectral density) and Other Emissions (OE) (e.g. RX spurious, TX spurious and unwanted emission not belonging to the UWB emissions), see clause 7.3 of ETSI EN 303 883 [1].

The peak power limit shall only to be measured at the frequency and the direction with the highest mean power spectral density.

OE emission shall only be considered in the operating bandwidth if the given UWB limits (UE limits for mean power and peak power) are not met. In this case OE shall be clearly identified.

The tests of any mitigation techniques are only relevant inside the operating bandwidth(s).



Figure 1: Concept of operating bandwidth including the relevant UWB related parameter

4.3 Transmitter Conformance Requirements

4.3.1 Operating Bandwidth

4.3.1.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.1.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.2 applies.

4.3.1.3 Limits

Any operating bandwidth of all the DUT shall lie within one permitted frequency range of operation of the device (see table 1) and shall be > 50 MHz.

4.3.1.4 Conformance

The conformance test suite for operating bandwidth shall be as defined in clause 6.5.3 of the present document.

Conformance shall be established under normal test conditions, see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.2 Maximum Value of Mean Power Spectral Density

4.3.2.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.2.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.3 applies.

4.3.2.3 Limits

The maximum mean power spectral density shall not exceed the limits given in table 2.

Table 2: Maximum value of mean power spectral density limit (e.i.r.p.) [i.6]

Frequency range [GHz]	Without mitigation techniques	With mitigation techniques
$f \leq 1,6$	-90 dBm/MHz	-90 dBm/MHz
$1,6 < f \leq 2,7$	-85 dBm/MHz	-85 dBm/MHz
$2,7 < f \leq 3,1$	-70 dBm/MHz	-70 dBm/MHz
$3,1 < f \leq 3,4$	-70 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$3,4 < f \leq 3,8$	-80 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$3,8 < f \leq 4,8$	-70 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$4,8 < f \leq 6$	-70 dBm/MHz	-70 dBm/MHz
$6 < f \leq 8,5$	-41,3 dBm/MHz	-41,3 dBm/MHz
$8,5 < f \leq 9$	-65 dBm/MHz	-41,3 dBm/MHz (note 2)
$9 < f \leq 10,6$	-65 dBm/MHz	-65 dBm/MHz
$10,6 < f$	-85 dBm/MHz	-85 dBm/MHz

NOTE 1: Within the band 3,1 GHz to 4,8 GHz, devices implementing **Low Duty Cycle (LDC) mitigation technique** (see clause 4.5.3) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz.

NOTE 2: Within the bands 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz, devices implementing **Detect And Avoid (DAA) mitigation technique** (see clause 4.5.1) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz.

4.3.2.4 Conformance

The conformance test suite for maximum value of mean power spectral density shall be as defined in clause 6.5.4.

Conformance shall be established under normal test conditions, see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.3 Maximum value of peak power

4.3.3.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.3.2 Description

The description of ETSI EN 303 883 [1], clause 7.2.4 applies.

4.3.3.3 Limits

The maximum peak power limit measured shall not exceed the limits given in table 3.

Table 3: Maximum peak power limit [i.6]

Frequency range [GHz]	Without mitigation techniques (defined in 50 MHz)	With mitigation techniques (defined in 50 MHz)
$f \leq 1,6$	-50 dBm	-50 dBm
$1,6 < f \leq 2,7$	-45 dBm	-45 dBm
$2,7 < f \leq 3,1$	-36 dBm	-36 dBm
$3,1 < f \leq 3,4$	-36 dBm	0 dBm (notes 1 and 2)
$3,4 < f \leq 3,8$ (notes 1 and 2)	-40 dBm	0 dBm (notes 1 and 2)
$3,8 < f \leq 4,8$ (notes 1 and 2)	-30 dBm	0 dBm (notes 1 and 2)
$4,8 < f \leq 6$	-30 dBm	-30 dBm
$6 < f \leq 8,5$	0 dBm	0 dBm
$8,5 < f \leq 9$ (note 2)	-25 dBm	0 dBm (note 2)
$9 < f \leq 10,6$	-25 dBm	-25 dBm
$10,6 < f$	-45 dBm	-45 dBm

NOTE 1: Within the band 3,1 GHz to 4,8 GHz, devices implementing **Low Duty Cycle (LDC) mitigation technique** (see clause 4.5.3) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz.

NOTE 2: Within the bands 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz, devices implementing **Detect And Avoid (DAA) mitigation technique** (see clause 4.5.1) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz.

4.3.3.4 Conformance

The conformance test suite for maximum value of peak power shall be as defined in clause 6.5.5.

Conformance shall be established under normal test conditions, see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.4 Exterior Limits

This requirement does not apply to any DUT.

4.3.5 Total Power

This requirement does not apply to any DUT.

4.3.6 Other Emissions

4.3.6.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.6.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.5 applies.

4.3.6.3 Limits

The equivalent isotropically radiated power of any of these other emissions (OE) in the spurious domain shall not exceed the values given in table 4.

Table 4: Other Emission limits (radiated)

Frequency range	Limit values for OE
47 MHz to 74 MHz	-54 dBm/100 kHz
87,5 MHz to 118 MHz	-54 dBm/100 kHz
174 MHz to 230 MHz	-54 dBm/100 kHz
470 MHz to 862 MHz	-54 dBm/100 kHz
otherwise in band 30 MHz to 1 000 MHz	-36 dBm/100 kHz
1 000 MHz to 40 000 MHz (see note)	-30 dBm/1 MHz
NOTE: Not applicable for UE emissions within the permitted range of frequencies.	

4.3.6.4 Conformance

The conformance tests for Other Emissions (OE) shall be as defined in clause 6.5.4.

Conformance shall be established under normal test conditions, see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.7 Transmitter Unwanted Emissions

This requirement does not apply to any DUT.

4.4 Receiver Conformance Requirements

4.4.1 General

For a detailed description of related UWB receiver requirements see ETSI TS 103 361 [4].

4.4.2 Receiver spurious emissions

4.4.2.1 Applicability

Receiver spurious emission testing shall apply only when the equipment can work in a receive-only mode or is a receive-only device.

NOTE: Otherwise receiver spurious emissions are measured as part of the other emissions, see clause 4.3.8.

4.4.2.2 Description

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.

4.4.2.3 Limits

The narrowband spurious emissions of the receiver shall not exceed the values in table 5 in the indicated bands (see CEPT/ERC/REC 74-01 [i.7]).

Table 5: Narrowband spurious emission limits for receivers

Frequency range	Limit
30 MHz to 1 GHz	-57 dBm (e.r.p.)
above 1 GHz to 40 GHz	-47 dBm (e.i.r.p.)

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage.

Wideband spurious emissions shall not exceed the values given in table 6.

Table 6: Wideband spurious emission limits for receivers

Frequency range	Limit
30 MHz to 1 GHz	-47 dBm/MHz (e.r.p.)
above 1 GHz to 40 GHz	-37 dBm/MHz (e.i.r.p.)

4.4.2.4 Conformance

The conformance test suite for receiver spurious emissions shall be as defined in clause 6.6.1.

Conformance shall be established under normal test conditions, see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.4.3 Receiver interference handling

4.4.3.1 Applicability

This requirement shall apply to all receiving DUT.

4.4.3.2 Description

Interferer signal handling, defined as the capability of the device to operate as intended in the presence of interferers, is the receiver parameter for UWB applications.

Operation as intended is evaluated using a performance criterion. For common applications, recommended performance criteria and test cases are defined in clause 9.4 of ETSI TS 103 361 [4]. For other applications, the manufacturer shall choose an appropriate performance criterion according to clause 9.2.1 of ETSI TS 103 361 [4]. The performance criterion shall be stated in the user manual (see clause 9.2.2 of ETSI TS 103 361 [4]).

4.4.3.3 Limits

The level of performance of the chosen performance criterion shall meet the minimum requirement defined in clause 9 of ETSI TS 103 361 [4].

4.4.3.4 Conformance

The conformance test suite for receiver interference handling shall be as defined in clause 6.6.2.

Conformance shall be established under normal test conditions, see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.5 Requirements for Spectrum Access

4.5.1 Detect and Avoid (DAA)

4.5.1.1 Applicability

This requirement shall apply to all devices that implement the DAA mitigation technique to avail themselves of the relaxed limits in Note 2 of table 2 (clause 4.3.2.3) and in Note 2 of table 3 (clause 4.3.3.3).

4.5.1.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.8 applies.

4.5.1.3 Limits

Limits for the DAA parameters sets shall be as given in ETSI TS 102 754 [2], annexes A to C.

4.5.1.4 Conformance

The conformance test suite for the detect and avoid (DAA) shall be as defined in clause 6.7.1.

Conformance shall be established under normal test conditions, see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.5.2 Listen-Before-Talk (LBT)

This requirement does not apply to any DUT.

4.5.3 Low Duty Cycle (LDC)

4.5.3.1 Applicability

This requirement shall apply to all devices that implement the LDC mitigation technique to avail themselves of the relaxed limits in note 1 of table 2 (clause 4.3.2.3) and note 1 of table 3 (clause 4.3.3.3).

4.5.3.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.9 applies.

4.5.3.3 Limits

The baseline limits for LDC shall be as given in table 7.

Table 7: Baseline limits for low duty cycle [i.2]

Parameter		Limit
Maximum transmitter on time	Ton max	5 ms per transmission
Mean transmitter off time	Toff mean	≥ 38 ms (averaged over 1 s)
Sum transmitter off time	∑ Toff	> 950 ms per second
Sum transmitter on time	∑ Ton	< 18 s per hour
NOTE: An LDC trade off, power versus time, as described in Annex C, shall be seen as an equivalent mitigation technique according to [i.6]; details see CEPT report 45 [i.8], clause 3.1.1.		

4.5.3.4 Conformance

The conformance test suite for Low Duty Cycle shall be as defined in clause 6.7.3.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.6 Antenna Requirements

These requirements do not apply to any DUT.

4.7 Other Requirements and Mitigation techniques

These requirements do not apply to any DUT.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at one or more representative point(s) within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

5.2 General conditions for testing

5.2.1 Product information

The requirements for the product information shall be as given in ETSI EN 303 883 [1], clause 5.2.

An application form for the DUT testing is provided in annex B.

5.2.2 Requirements for the test modulation

The requirements for the test modulation shall be as given in ETSI EN 303 883 [1], clause 5.3.

5.2.3 Test conditions, power supply and ambient temperatures

The test conditions, power supply and ambient temperatures shall be as given in ETSI EN 303 883 [1], clause 5.4.

5.2.4 Choice of equipment for test suites

The choice of the equipment for the test suites shall be as given in ETSI EN 303 883 [1], clause 5.5.

5.2.5 Multiple Operating bandwidths and multiband equipment

Where equipment has more than one operating bandwidth (e.g. 500 MHz and 1 300 MHz), a minimum of two operating bandwidths shall be chosen such that the lower and higher limits of the operating range(s) of the equipment are covered (see clause 4.2). All operating bandwidths of the equipment shall be declared by the equipment manufacturer.

In case of multiband equipment (i.e. equipment that can operate with an operating bandwidth below 4,8 GHz and above 6,0 GHz), the lowest and highest channel in operation of each band shall be tested.

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

Testing of host connected equipment and plug-in radio devices measurements shall be as given in ETSI EN 303 883 [1], clause 5.6.

5.3 Interpretation of the measurement results

5.3.0 General

Interpretation of the measurement results shall be as given in ETSI EN 303 883 [1], clause 5.7.

5.3.1 Measurement uncertainty is equal to or less than maximum acceptable uncertainty

If measurement uncertainty is equal to or less than maximum acceptable uncertainty the interpretation shall be as given in ETSI EN 303 883 [1], clause 5.7.2.

5.3.2 Measurement uncertainty is greater than maximum acceptable uncertainty

If measurement uncertainty is greater than maximum acceptable uncertainty the interpretation shall be as given in ETSI EN 303 883 [1], clause 5.7.3.

5.3.3 Emissions

The provisions of ETSI EN 303 883 [1], clause 5.8 shall apply.

6 Conformance test suits

6.1 Introduction

In this clause the general setup of a test bed for the test of UWB equipment will be described.

A detailed introduction shall be considered as in ETSI EN 303 883 [1], clause 6.1.

6.2 Initial Measurement steps

Initial measurement steps shall be done as described in ETSI EN 303 883 [1], clause 6.2.

6.3 Radiated measurements

6.3.1 General

The provisions of ETSI EN 303 883 [1], clause 6.3.1 shall apply.

6.3.2 Test sites and general arrangements for measurements involving the use of radiated fields

The provisions of ETSI EN 303 883 [1], clause 6.3.2 shall apply.

6.3.3 Guidance on the use of a radiation test site

6.3.3.1 General

The provisions of ETSI EN 303 883 [1], clause 6.3.3 shall apply.

6.3.3.2 Range length.

The provisions of ETSI EN 303 883 [1], clause 6.3.3.5 shall apply.

6.3.4 Coupling of signals

The provisions of ETSI EN 303 883 [1], clause 6.3.4 shall apply.

6.3.5 Standard test methods

6.3.5.1 Generic measurement method

6.3.5.1.1 Calibrated setup

The provisions of ETSI EN 303 883 [1], clause 6.3.5.2 shall apply.

6.3.5.1.2 Substitution method

The provisions of ETSI EN 303 883 [1], clause 6.3.5.3 shall apply.

6.3.6 Standard calibration method

The provisions of ETSI EN 303 883 [1], clause 6.3.6 shall apply.

6.4 Conducted measurements

6.4.1 General Setup

The provisions of ETSI EN 303 883 [1], clause 6.4 shall apply.

6.4.2 Specific Setup

This requirement does not apply to any DUT.

6.5 Conformance methods of measurement for transmitter

6.5.1 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.);
- the operating bandwidth(s);
- the receiver spurious emissions;
- Other Emissions (OE);
- Low Duty Cycle (LDC), when applicable;
- Detect And Avoid (DAA), when applicable.

The following methods of measurement shall apply to the testing of stand-alone units and to the equipment configurations identified in clause 5.2.6.

6.5.2 Method of measurements of the Ultra Wideband Emissions

Method of measurements of the Ultra Wideband Emissions shall be as given in ETSI EN 303 883 [1], clause 7.3.

6.5.3 Operating Bandwidth

Operating bandwidth measurements shall be performed as given in ETSI EN 303 883 [1], clause 7.4.2.

The results for f_L , f_H , f_M , OBW, and f_C shall be reported in the test report.

6.5.4 Mean power spectral density measurements

Mean power spectral density measurements shall be as given in ETSI EN 303 883 [1], clause 7.4.3.

To classify the Ultra wide band part (clause 4.3.2) and the other emissions (clause 4.3.6) of the radiated emission the initial measurement steps given in ETSI EN 303 883 [1], clause 7.3.2 shall be used.

The measurement method used and the maximum observed value for the mean power spectral density shall be recorded in the test report.

6.5.5 Peak power measurements

Peak power measurements shall be as given in ETSI EN 303 883 [1], clause 7.4.4.

The measurement method used and the maximum value for the peak power shall be recorded in the test report.

6.5.6 Exterior limit measurement

Not applicable.

6.5.7 Total Power

Not applicable.

6.5.8 Transmitter unwanted emissions

Not applicable.

6.6 Conformance methods of measurement for receiver

6.6.1 Receiver spurious emissions

Receiver spurious emissions measurements shall be as given in ETSI EN 303 883 [1], clause 7.4.5.

The measurement method, level and type (narrowband or wideband) of spurious emissions shall be recorded in the test report.

6.6.2 Receiver interference handling

Interference signal handling measurements shall be as given in clause 9 of ETSI TS 103 361 [4].

The interferer test frequency range, interferers and interferer power levels, test scenario, performance criterion and level of performance shall be recorded in the test report.

6.7 Conformance test suites for spectrum access

6.7.1 Detect and Avoid (DAA)

Test procedures for DAA mechanisms shall be as given in ETSI EN 303 883 [1], clause 7.4.7.

The following test parameters shall be used:

$$m = 10$$

$$n = 5$$

6.7.2 Listen Before Talk

Not applicable.

6.7.3 Low Duty Cycle

Test procedures for low duty cycle shall be as given in ETSI EN 303 883 [1], clause 7.4.8.

6.7.4 Conformance test suites for antenna requirements

Not applicable.

6.7.5 Other Test Suites

Not applicable.

Annex A (normative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.10] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table A.1: Relationship between the present document and the essential requirements of Directive 2014/53/EU

Harmonised Standard ETSI EN 302 065-1				
The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [i.1]				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	Operating bandwidth	4.3.1	C	All transmitting devices
2	Maximum value of mean power spectral density	4.3.2	C	All transmitting devices
3	Maximum value of peak power	4.3.3	C	All transmitting devices
4	Other emissions	4.3.6	C	All transmitting devices
5	Receiver spurious emissions	4.4.2	C	Applies only to equipment that can be operated in a receive-only mode
6	Receiver interference handling	4.4.3	C	All receiving devices
7	Detect-and-avoid	4.5.1	C	Applies only to equipment operating in the frequency band 3,1 GHz to 4,8 GHz and having DAA
8	Detect-and-avoid	4.5.1	C	Applies only to equipment operating in the frequency band 8,5 GHz to 9 GHz and having DAA
9	Low Duty Cycle	4.5.3	C	Applies only to equipment with LDC implemented in the frequency range: 3,1 GHz to 4,8 GHz

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 shall 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 requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (informative): Application form for testing

B.1 Introduction

Notwithstanding the provisions of the copyright clause related to the text of the present document, ETSI grants that users of the present document may freely reproduce the application form proforma in this annex so that it can be used for its intended purposes and may further publish the completed application form.

The form contained in this annex may be used by the manufacturer to comply with the requirement contained in clause 4 to provide the necessary information about the equipment to the test laboratory prior to the testing. It contains product information as well as other information which might be required to define which configurations are to be tested, which tests are to be performed as well the test conditions.

This application form should form an integral part of the test report.

B.2 Product Information for ETSI EN 302 065-1, clause 5.2.1

B.2.1 Type of Equipment (stand-alone, combined, plug-in radio device, etc.)

- Stand-alone
- Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
- Plug-in radio device (Equipment intended for a variety of host systems)
- Other

B.2.2 The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices

- Details provided are for the: stand-alone equipment
 combined (or host) equipment
 test jig
- Supply Voltage AC mains State AC voltage V
 DC State DC voltage V

In case of DC, indicate the type of power source

- Internal Power Supply
- External Power Supply or AC/DC adapter
- Battery
- Other:

B.3 Signal related Information for ETSI EN 302 065-1, clause 4.3

B.3.1 Introduction

In accordance with ETSI EN 302 065-1, clause 4.3, the following information is provided by the manufacturer.

B.3.2 Operating bandwidth(s) of the equipment

- Operating bandwidth 1: MHz to MHz
- Operating bandwidth 2: MHz to MHz

NOTE: Add more lines if more Frequency Ranges are supported.

B.3.3 The worst case mode for each of the following tests

NOTE: In this section specify the Operational mode and not the measured value. e.g. test mode 1, etc.

- Operating bandwidth(s)
.....
- Mean Power Spectral Density / Peak Power Spectral Density / Other Emissions
.....

B.4 RX test Information for ETSI EN 302 065-1, clause 4.4

B.4.1 Introduction

In accordance with ETSI EN 302 065-1, clause 4.4, the following information is provided by the manufacturer.

B.4.2 Performance criterion and level of performance

- Performance criterion (e.g. accuracy, sensitivity)
.....
- Level of performance (e.g. for accuracy ± 10 %, level of sensitivity)
.....

B.4.3 Interfering signals

Frequency [MHz]	Power [dBm]	Type of signal (e.g. CW, CW with DC, other modulation)

B.5 Information on spectrum access by ETSI EN 302 065-1, clause 4.5

B.5.1 Introduction

In accordance with ETSI EN 302 065-1, clause 4.5, the following information is provided by the manufacturer.

B.5.2 Spectrum access

NOTE 1: If there is a specific mode for testing the manufacture have to declare.

NOTE 2: Table with different parameters for different mitigation techniques.

- DAA
- LDC
 - a) Frequency range A
 - Frequency range B
 - Frequency range C
 - b) Ton, max
 - c) Toff, mean
 - d) \sum Toff in 1s
 - e) \sum Ton in 1h
 - f) Tdis

B.6 Additional information provided by the applicant

B.6.1 About the DUT

- The equipment submitted are representative production models.
- If not, the equipment submitted are pre-production models?
- If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested.
- If not, supply full details:
 -
 -
- The equipment submitted is CE marked.
- In addition to the CE mark, the Class-II identifier (Alert Sign) is affixed.

B.6.2 Additional items and/or supporting equipment provided

- Spare batteries (e.g. for portable equipment).

- Battery charging device.
- External Power Supply or AC/DC adapter.
- Test Jig or interface box.
- RF test fixture (for equipment with integrated antennas).
- Host System Manufacturer:
- Model #:
- Model name:
- Combined equipment Manufacturer:
- Model #:
- Model name:
- User Manual.
- Technical documentation (Handbook and circuit diagrams)

Annex C (normative): Equivalent mitigation techniques

C.1 Equivalent mitigation techniques and LDC limits

Different 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 they 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.3]).

EXAMPLE: 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.3].

The manufacturer shall provide compliance with the transmission emission limits in tables 2 and 3 when using equivalent mitigation techniques.

NOTE: Regulations in the Commission Decision 2007/131/EC [i.4] 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.

Based on CEPT report 45 [i.8] the combinations of LDC limits and the transmitter emission limits as shown in table C.1, may give an equivalent protection as the current baseline LDC limits (see ECC/DEC/(06)04 [i.2], table 6).

C.2 Test Procedure

The manufacturer shall provide sufficient information for determining compliance with the limits given in table C.1.

C.3 Limit

The limits for equivalent LDC shall be as given in table C.1. These values are defined in CEPT report 45 [i.8].

Table C.1: Limits for low duty cycle to have appropriate mitigation

mean power spectral density limit (e.i.r.p.) [dBm/MHz]	Maximum transmitter on time % in 1 second	T _{on} max [ms]	T _{off} mean [ms]	$\sum T_{on} / 1sec$ [ms]	min $\sum T_{off} / 1sec$ [ms]	Long term LDC [sec in 1hr]
-41,3	5	5	≥ 38	< 50	> 950	18
-44,3	10	10	≥ 38	< 100	> 900	36
-47,3	20	20	≥ 38	< 200	> 800	72
-50,3	40	40	≥ 38	< 400	> 600	144
-51,3	50	50	≥ 38	< 500	> 500	180

Annex D (informative): Measurement antenna, preamplifier, and cable specifications

The radiated measurements set-up in annex B of ETSI EN 303 883 [1] specifies the use of a horn antenna and a wide-band high gain preamplifier above 1 GHz in order to measure the very low radiated power density level from UWB equipment.

Table D.1 gives examples of recommended data and features for the horn antenna and preamplifier to be used for the test set-up.

Table D.1: Recommended Hardware

Device	Parameter	Value
Preamplifier LNA	Bandwidth	< 1 GHz to > 15 GHz
	NF	< 2,5 dB
	Gain	> 30 dB
	Gain flatness across band	±1,5 dB
	VSWR in/out across band	< 2:1
	Nominal impedance	50 Ω
RX Horn Antenna	3 dB bandwidth	< 1 GHz to > 15 GHz
	VSWR across band	< 1,5:1
	Gain (10GHz)	> 16 dBi
	Gain (8GHz)	> 14 dBi
	Gain (6GHz)	> 12,5 dBi
	Gain (2-5GHz)	> 10 dBi
Cable	Nominal impedance	50 Ω
	VSWR	< 1,2:1
	Shielding	> 60 dB
	Losses	Take losses into account for total gain calculations
NOTE:	The noise floor of the combined equipment should be at least 6 dB below the specified limits, but 10 dB would be optimal.	

Annex E (informative): Bibliography

ERA Report 2006-0713: "Conducted and radiated measurements for low level UWB emissions".

ETSI TR 102 070-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide to the application of harmonised standards to multi-radio and combined radio and non-radio equipment; Part 2: Effective use of the radio frequency spectrum".

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 101 538: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); UWB location tracking devices in the railroad environment".

ETSI TS 103 085 (10-2012): "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".

ETSI TS 103 060: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Method for a harmonized definition of Low Duty Cycle transmission (LDC) as a passive mitigation technique used by short range devices and related conformance test methods".

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).

ETSI EN 301 489-33 (V2.1.1): "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Harmonised Standard covering the essential requirements of article 3.1b of the Directive 2014/53/EU; Part 33: Specific conditions for Ultra Wide Band (UWB) devices".

Annex F (informative): Change history

Date	Version	Information about changes
April 2014	1.3.1	Last publication as HS under R&TTE
November 2016	2.1.1	<ul style="list-style-type: none">• Revision for compliance with Directive 2014/53/EU• Out-sourcing of standard measurement procedures into a separate EN 303 883 (V1.1.1)• More detailed description of receiver spurious emission requirements• New requirement on Interferer signal handling• New Annex B "Application form for testing"• New Annex C "Equivalent mitigation techniques"

History

Document history		
V1.1.1	February 2008	Publication as ETSI EN 302 065
V1.2.1	October 2010	Publication as ETSI EN 302 065
V1.3.1	April 2014	Publication
V2.1.0	April 2016	EN Approval Procedure AP 20160705: 2016-04-06 to 2016-07-05
V2.1.1	November 2016	Publication