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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.13] 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 3 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.12].

National transposition dates	
Date of adoption of this EN:	18 July 2016
Date of latest announcement of this EN (doa):	31 October 2016
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).

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# 1 Scope

The present document applies to transceivers, transmitters and receivers utilizing Ultra Wide Band (UWB) technologies and used for short range applications in road and rail vehicles, which includes devices mounted inside or at the surface. The present document applies to impulse, modified impulse and RF carrier based UWB technologies in the main operating frequency ranges from 3,1 GHz to 4,8 GHz or from 6 GHz to 9 GHz.

Examples of applications for road and rail vehicles are:

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

The present document does not apply to fixed road infrastructure installations. For fixed rail infrastructure tracking applications see ETSI TR 101 538 [i.10] and ETSI TS 103 085 [i.11].

NOTE: As per the ECC/DEC/(06)04 [i.2] and Decision 2014/702/EC [i.4] 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].

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

**Table 1: Permitted range and intended range of operation [i.4]**

Permitted range of operation (note 1)	
Transmit	30 MHz to 10,6 GHz
Receive	30 MHz to 10,6 GHz
Intended ranges of operation (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 EN applies as such. Harmonised EN may specify additional EN requirements relevant to the presumption of conformity under article 3.2 of the Radio Equipment Directive (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.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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] ETSI TS 103 361 (V1.1.1) (03-2016): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Receiver technical requirements, parameters and measurement procedures to fulfil the requirements of the Directive 2014/53/EU".

## 2.2 Informative 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.

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 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 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.5] CEPT/ERC Recommendation 74-01: "Unwanted emissions in the spurious domain".
- [i.6] 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.7] 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.8] ETSI TR 102 070-2 (V1.1.1) (11-2002): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide to the application of harmonized standards to multi-radio and combined radio and non-radio equipment; Part 2: Effective use of the radio frequency spectrum".
- [i.9] ETSI TR 103 086 (V1.1.1) (03-2013): "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.10] ETSI TR 101 538: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); UWB location tracking devices in the railroad environment".



- [i.11] ETSI TS 103 085: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB) for Location and Tracking railroad applications; RF conformance testing".
- [i.12] ETSI EN 302 065-1 (V2.1.0) "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".
- [i.13] 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 definitions given in ETSI EN 303 883 [1] and the following apply:

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

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

### 3.2 Symbols

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

d	distance
k	coverage factor
$\varphi$	azimuth angle

### 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

## 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 increased 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 dB 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 an 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 required 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 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 test of required mitigation techniques are only relevant inside the operating bandwidth(s).

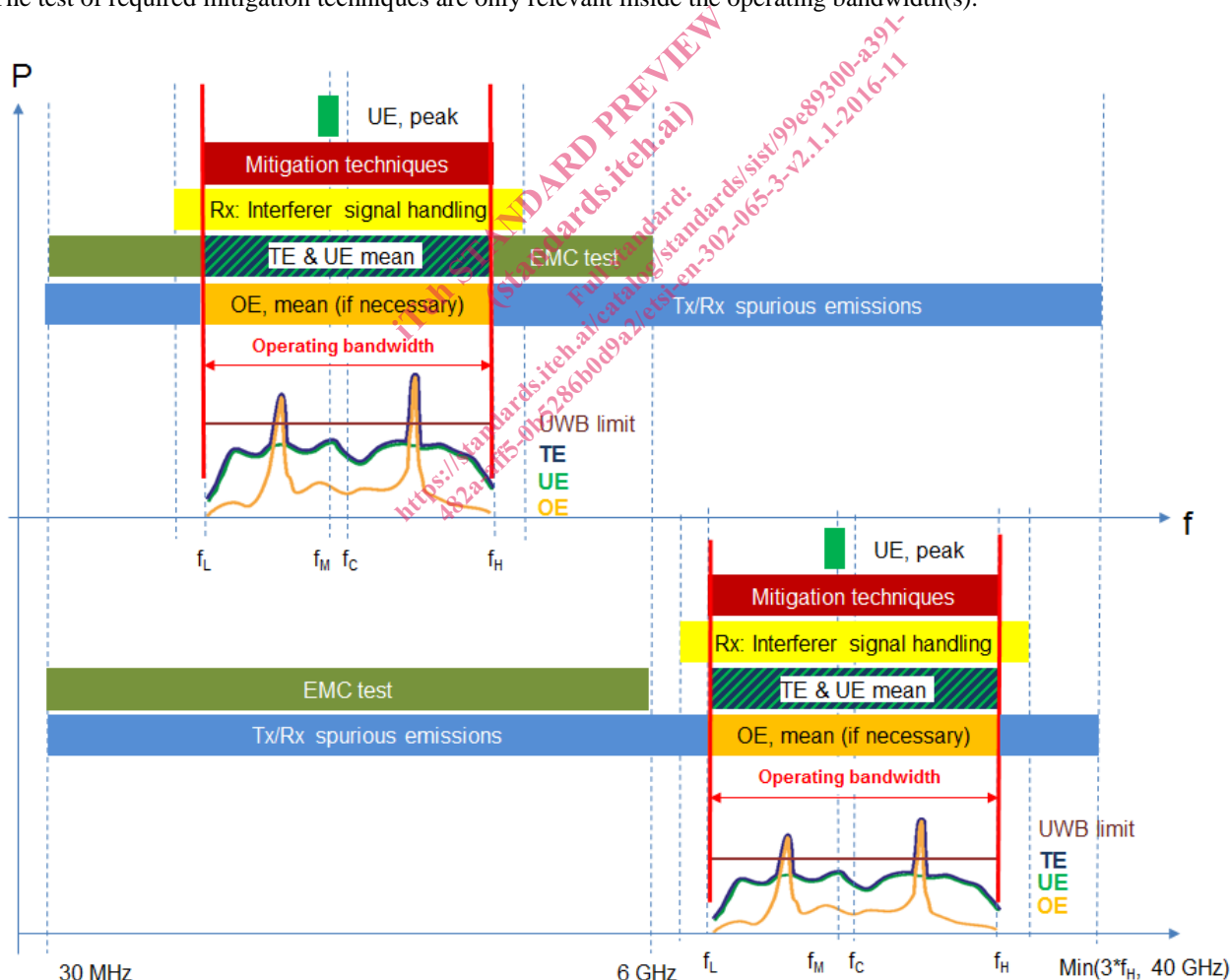


Figure 1: Concept of operating bandwidth including the relevant UWB related parameter

## 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.

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.)  
(Commission Decision 2014/702/EU [i.4])**

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)
$3,8 < f \leq 4,2$	-70 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$4,2 < f \leq 4,8$	-70 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$4,8 < f \leq 6$	-70 dBm/MHz	-70 dBm/MHz
$6 < f \leq 8,5$	-53,3 dBm/MHz	-41,3 dBm/MHz (notes 1 and 3)
$8,5 < f \leq 9$	-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 and 6 GHz to 8,5 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. Operation is in addition subject to the implementation of an exterior limit (see clause 4.3.4) of -53,3 dBm/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. Operation is in addition subject to the implementation of Transmit Power Control (TPC) mitigation technique (see clause 4.6) and an exterior limit (see clause 4.3.4) of -53,3 dBm/MHz.

NOTE 3: Within the band 6 GHz to 8,5 GHz devices implementing Transmit Power Control (TPC) mitigation technique (see clause 4.7.1) and an exterior limit (see clause 4.3.4) of -53,3 dBm/MHz 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 in 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.