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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 4: Material Sensing devices using UWB technology below 10,6 GHz;

Reference
DEN/ERM-TGUWB-132

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Foreword

This draft Harmonised 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 prepared under the Commission's standardisation request C(2015) 5376 final [i.11] 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.4].

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 4 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.10].

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

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.

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 Directive 2014/53/EU [i.4].

1 Scope

The present document specifies the requirements for **material sensing** applications using UWB technology operating in all or part of the frequency band from 2,2 GHz to 8,5 GHz. Additionally, it specifies reduced emissions in the ranges from 0,96 GHz to 2,2 GHz and 8,5 GHz to 10,6 GHz.

The present document applies to:

1) Material Sensing devices: a device enabling radio determination application designed to detect the location of objects within a structure or to determine the physical properties of a material.

2) Equipment fitted with a non-user changeable antenna.

3) The main categories are:

   a) Non fixed material sensors;

   b) Non fixed building material sensors;

   c) Fixed material sensors.

The present document does not apply to:

- UWB communication devices;
- Ground and wall probing radar devices;
- Through-wall radar imaging devices; and
- (Tank) Level Probing devices.

Equipment covered by the present document operates in accordance with ECC/DEC(07)01 [i.7] and Commission Decision 2009/343/EC [i.6].

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

Table 1: Permitted range of operation [i.6]

Intended frequency bands	
Transmit	2,2 GHz to 8,5 GHz
Receive	2,2 GHz to 8,5 GHz
Permitted range of operation	
Transmit	30 MHz to 10,6 GHz
Receive	30 MHz to 10,6 GHz
NOTE: The UWB radio device can also operate outside of the intended range of operation and inside the permitted range of operation provided that the limits in clause 4.3.2 and 4.3.4.2, table 2 or table 3 are met.	

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 https://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) (02-2016): "Short Range Devices (SRD) using Ultra Wide Band (UWB); Measurement Techniques".

[2] 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] 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.2] 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.3] CEPT/ERC Recommendation 74-01: "Unwanted emissions in the spurious domain".

[i.4] 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.5] 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.6] 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 harmonized manner in the Community (notified under document number C(2009) 2787) (Text with EEA relevance).

[i.7] ECC/DEC/(07)01: "ECC Decision of 30 March 2007 on specific Material Sensing devices using Ultra-Wideband (UWB) technology (amended 26 June 2009)".

[i.8] 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.9] 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.10] 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.11] 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:

exterior limits: regulatory limits defined and measured around a specific setup or measurement scenario

fixed installation: installation of the UWB equipment where the relative spatial emission characteristics do not change during the operation of the equipment

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:

c	velocity of light in a vacuum
cl1	cable loss 1
cl2	cable loss 2
E	Electrical field strength
E_R	relative dielectric constant of earth materials
E_{rms}	Average electrical field strength measured as root mean square
f_M	frequency at which the peak power emission occurs
G(f)	Antenna gain over frequency
G_A	Gain of the measurement antenna
G_{LNA}	Gain of the measurement LNA
$P_{e.i.r.p.}$	spectral power density
P_m	measured spectral power
P_{victim}	power of a different device at the material sensor
$P_{wall, e.i.r.p.}$	undesired spectral power density, here: wall as absorbing material
R	Distance
rms	Root mean square
T_P	pulse rise time
Z_{F0}	Free space wave impedance
δR	range resolution
δt	time interval between the arrivals of two signals from targets separated in range by δR
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:

BMA	Building Material Analysis
CEPT	Conférence Européenne des administrations de Postes et des Télécommunications
CW	Continuous Wave
dB	deciBel
dBi	gain in deciBel relative to an isotropic antenna
dBm	deciBel reference to 1 mW
e.r.p.	equivalent radiated power
EC	European Commission
EN	European Norm

ERC	European Radiocommunication Committee
IT	Information Technology
LBT	Listen Before Talk
MSS	Mobile Satellite Service
NF	Noise Figure
PRI	Pulse Repetition Interval
R&TTE	Radio and Telecommunications Terminal Equipment
SRD	Short Range Device
TH	ThresHold
TP	Total Power
TP-UE	Total Power of Undesired (UWB) Emissions
TR	Technical Report
TRP	Total Radiated Power
TS	Technical Specification
UMTS	Universal Mobile Telecommunication System

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 supplier. 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 operational frequencies 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 operational bandwidth of the UWB equipment under test. The operating bandwidth of the UWB equipment under 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 operational bandwidth. The basic concept is depicted in Figure 1. Here two separate operational bandwidths are depicted, one with a UWB operational bandwidth in the lower frequency range and one in the upper frequency range. All UWB related emissions shall be measured in the identified operational bandwidth of the UWB device under test. The required mitigation techniques are only valid in the operational bandwidth.

The RX interferer signal handling is focused in the operational bandwidth and some clearly identified frequencies outside the operational bandwidth(s).

The operating bandwidth(s) is/are parts of the permitted range of operation, see table 1.

The test of required mitigation techniques are only relevant inside the operating bandwidth(s).

Receiver interferer signal handling are relevant on the operating bandwidth and at defined frequencies below and above the operating range limits.

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)

OE shall only be considered in the operational bandwidth if the given UWB mean power limits are not met. In this case OE shall be clearly identified.

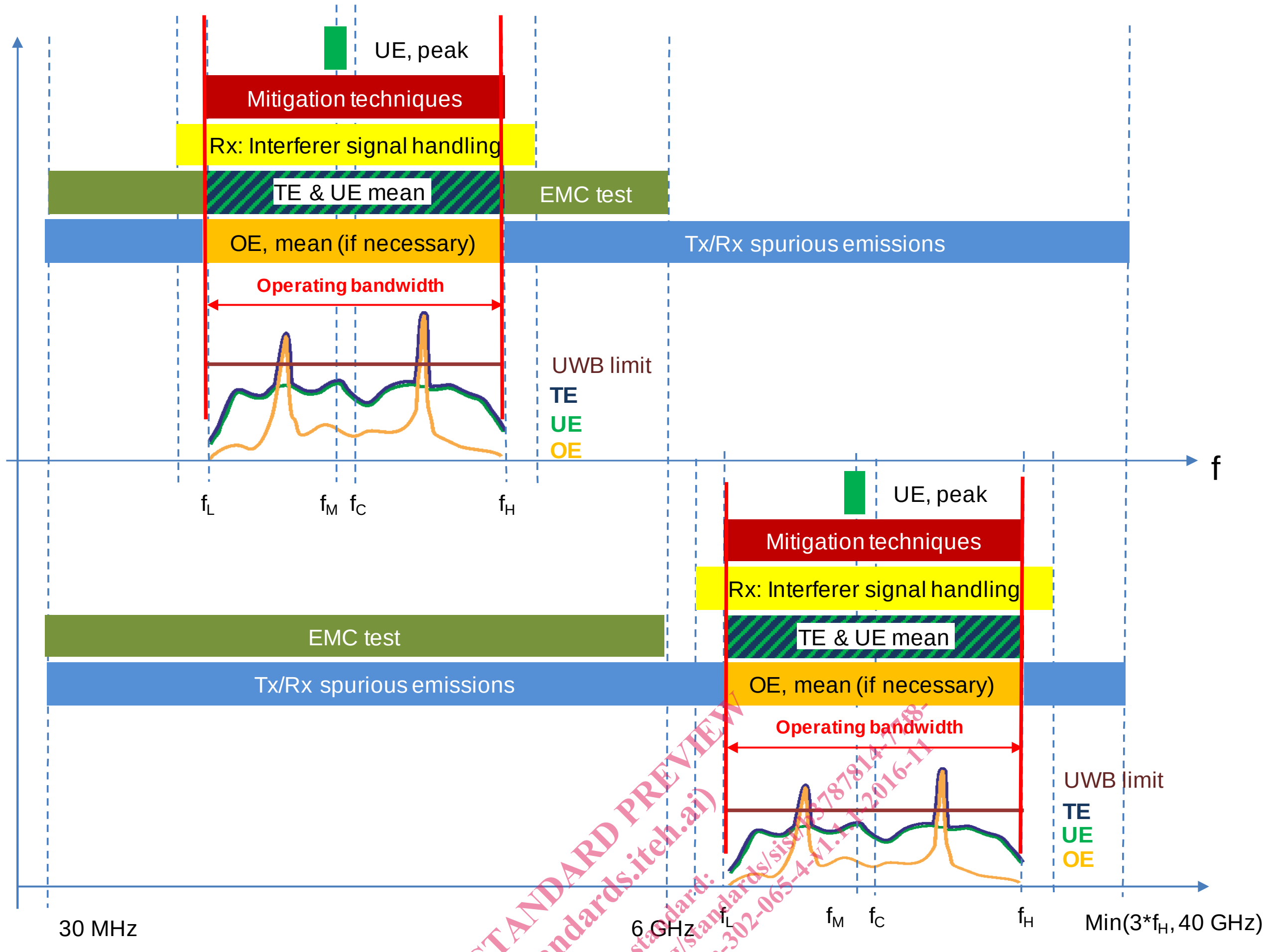

Figure 1: Concept of operational bandwidth including the relevant UWB related parameter

4.3 Transmitter conformance requirements

4.3.1 Operating bandwidth

4.3.1.1 Applicability

This requirement shall apply to all equipment under test.

4.3.1.2 Description

See Reference to definition in ETSI EN 303 883 [1], clause 7.2.2.

4.3.1.3 Limits

The measured results of the operating bandwidth shall be recorded. The operating bandwidth shall be in the permitted range of operation as given in table 1.

The limits of operating bandwidth shall be met under normal test conditions as defined in clause 5.4.3 of ETSI EN 303 883 [1].

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.