



**Short Range Devices (SRD)  
using Ultra Wide Band technology (UWB);  
Harmonised Standard for access to radio spectrum;  
Part 4: Material Sensing devices;  
Sub-part 1: Building material analysis below 10,6 GHz**

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# Contents

Intellectual Property Rights .....	6
Foreword.....	6
Modal verbs terminology.....	8
Introduction .....	8
1 Scope .....	9
2 References .....	9
2.1 Normative references .....	9
2.2 Informative references.....	10
3 Definition of terms, symbols and abbreviations.....	11
3.1 Terms.....	11
3.2 Symbols.....	11
3.3 Abbreviations .....	12
4 Technical requirements specifications .....	12
4.1 Environmental profile.....	12
4.2 EUT categories .....	12
4.2.1 General.....	12
4.2.2 Categorization by Regulation .....	12
4.2.3 Categorization by Modulation .....	13
4.2.4 Categorization by Active Mitigation Techniques .....	13
4.2.5 Summary EUT categories .....	13
4.3 Transmitter requirements .....	14
4.3.1 General.....	14
4.3.2 Operating Frequency Range (OFR).....	14
4.3.2.1 Applicability.....	14
4.3.2.2 Description Operating Frequency Range .....	14
4.3.2.3 Limits for Operating Frequency Range.....	15
4.3.2.3.1 Limit requirement for BMA2, BMA3, BMA4 and BMA5 categories .....	15
4.3.2.3.2 Limit requirement for BMA1 category.....	15
4.3.2.4 Conformance.....	15
4.3.3 Mean e.i.r.p. ....	15
4.3.3.1 Applicability.....	15
4.3.3.2 Description Mean e.i.r.p. ....	15
4.3.3.3 Limits for Mean e.i.r.p. ....	15
4.3.3.4 Conformance.....	16
4.3.4 Indirect Emissions .....	16
4.3.4.1 Applicability.....	16
4.3.4.2 Description Indirect Emission.....	16
4.3.4.3 Limits for Indirect Emission .....	16
4.3.4.3.1 Limits for Indirect Emissions for EUT categories BMA2 and BMA3 .....	16
4.3.4.3.2 Indirect Emissions for EUT categories BMA4 and BMA5 .....	17
4.3.4.4 Conformance.....	18
4.3.5 TX Unwanted Emissions (TXUE).....	18
4.3.5.1 Applicability.....	18
4.3.5.2 Description TX unwanted emissions.....	18
4.3.5.3 Limits for TXUE.....	18
4.3.5.3.1 TXUE limit for EUT category BMA1 .....	18
4.3.5.3.2 TXUE limit for EUT categories BMA2, BMA3, BMA4 and BMA5.....	19
4.3.5.4 Conformance.....	19
4.3.6 Total Radiated Mean e.i.r.p. Spectral Density (TRP <sub>SD</sub> ).....	19
4.3.6.1 Applicability.....	19
4.3.6.2 Description Total Radiated Power .....	19
4.3.6.3 Limits for Total Radiated Power .....	20
4.3.6.3.1 TRP <sub>SD</sub> limit for EUT categories BMA2 and BMA3.....	20
4.3.6.3.2 TRP <sub>SD</sub> limit for EUT categories BMA4 and BMA5.....	20
4.3.6.4 Conformance.....	20

4.3.7	Listen Before Talk (LBT).....	20
4.3.7.1	Applicability.....	20
4.3.7.2	Description of Listen Before Talk.....	21
4.3.7.3	Limits for Listen Before Talk.....	21
4.3.7.4	Conformance.....	21
4.3.8	Duty Cycle.....	21
4.3.8.1	Applicability.....	21
4.3.8.2	Description of Duty Cycle.....	21
4.3.8.3	Limits for Duty Cycle.....	21
4.3.8.4	Conformance.....	22
4.3.9	TX behaviour under the complete environmental profile (TXb).....	22
4.3.9.1	Applicability.....	22
4.3.9.2	Description.....	22
4.3.9.3	Limits for radiated assessment of the TX behaviour.....	22
4.3.9.4	Conformance.....	23
4.4	Receiver requirements.....	23
4.4.1	General.....	23
4.4.2	Wanted technical performance criteria.....	23
4.4.3	Receiver Baseline Sensitivity (RBS).....	23
4.4.3.1	Applicability.....	23
4.4.3.2	Description for the RBS requirements.....	23
4.4.3.3	Limits.....	23
4.4.3.4	Conformance.....	24
4.4.4	Receiver Baseline Resilience (RBR).....	24
4.4.4.1	Applicability.....	24
4.4.4.2	Description for the RBR requirement.....	24
4.4.4.3	Limits.....	24
4.4.4.4	Conformance.....	24
5	Testing for compliance with technical requirements.....	24
5.1	Environmental conditions for testing.....	24
5.1.1	General.....	24
5.1.2	Normal test conditions.....	24
5.1.3	Complete environmental profile test conditions.....	24
5.2	Conformance test suites and general conditions for testing.....	25
5.2.1	General.....	25
5.2.2	Disregard time ( $T_{dis}$ ).....	25
5.2.3	Threshold - level ( $P_{thresh}$ ).....	25
5.2.4	EUT orientation and reference points.....	25
5.2.5	Test scenarios and setup for transmitter conformance tests.....	26
5.2.5.1	For EUT category BMA1.....	26
5.2.5.2	For EUT categories BMA2, BMA3, BMA4 and BMA5.....	26
5.3	Conformance methods of measurement for TX requirements.....	28
5.3.1	Operating Frequency Range (OFR).....	28
5.3.1.1	OFR assessment parameter X.....	28
5.3.1.2	OFR conformance test EUT category BMA1.....	28
5.3.1.3	OFR conformance test EUT categories BMA2, BMA3, BMA4 and BMA5.....	28
5.3.2	Mean e.i.r.p.....	29
5.3.3	Indirect emissions.....	30
5.3.4	TX unwanted emissions.....	31
5.3.4.1	General.....	31
5.3.4.2	TXUE conformance test for EUT category BMA1.....	32
5.3.4.2.1	General.....	32
5.3.4.2.2	Unwanted emissions within spurious domain.....	32
5.3.4.2.3	Unwanted missions within out-of-band domain.....	32
5.3.4.3	TXUE conformance test for EUT categories BMA2, BMA3, BMA4 and BMA5.....	32
5.3.5	Total Radiated Mean e.i.r.p. Spectral Density ( $TRP_{SD}$ ).....	33
5.3.6	Listen Before Talk (LBT).....	33
5.3.7	Duty Cycle.....	35
5.3.8	TX behaviour under the complete environmental profile.....	36
5.3.8.1	General.....	36
5.3.8.2	Conformance test procedures.....	36

5.3.8.2.1	Conformance test procedure for EUT category BMA1 .....	36
5.3.8.2.2	Conformance test procedure for EUT categories BMA2, BMA3, BMA4 and BMA5 .....	36
5.4	Conformance methods of measurement for receiver .....	37
5.4.1	General for RBS and RBR conformance tests .....	37
5.4.2	Receiver Baseline Sensitivity (RBS) .....	37
5.4.2.1	RBS test for BMA category .....	37
5.4.3	Receiver Baseline Resilience (RBR) .....	38
5.4.3.1	RBR test for BMA category .....	38
<b>Annex A (informative):</b>	<b>Relationship between the present document and the essential requirements of Directive 2014/53/EU .....</b>	<b>40</b>
<b>Annex B (informative):</b>	<b>Selection of technical parameters .....</b>	<b>42</b>
<b>Annex C (normative):</b>	<b>BMA EUT Category: Use-Case, wanted technical performance criteria and RX-test conditions.....</b>	<b>45</b>
C.1	Description .....	45
C.2	Wanted Technical Performance Criteria (WTPC) and RX - requirement.....	45
C.2.1	General .....	45
C.2.2	RBS-requirement and limit.....	45
C.2.3	RBR requirement and limit .....	46
C.3	Test-wall for RX-Measurement.....	46
C.3.1	Description test-wall for RX-measurement.....	46
C.3.2	Technical Details for RX Test-wall.....	47
C.3.2.1	Specification of the Gypsum board.....	47
C.3.2.2	Specification of the Rebar.....	47
C.3.2.3	Specification of the Wood Frame .....	47
<b>Annex D (normative):</b>	<b>Interferer for RBR test.....</b>	<b>48</b>
D.1	Interferer requirements for RBR tests .....	48
D.1.1	General test frequencies for RBR tests .....	48
D.1.2	Test frequencies for EUT with OFR < 500 MHz .....	48
D.1.3	Test frequencies for EUT with OFR ≥ 500 MHz .....	49
D.1.4	Interferer power levels and modulation.....	49
D.2	Interferer test signals for EUT category BMA1 .....	50
D.3	Interferer test signals for EUT categories BMA2, BMA3, BMA4 and BMA5.....	51
D.3.1	Interferer test signals .....	51
D.3.2	Assessment if no interferer test signal provided at calculated test frequency .....	52
D.4	List of interferer for RBR test; assessment procedure.....	53
D.4.1	General .....	53
D.4.2	Assessment list of relevant interferer .....	54
D.4.2.1	Basic considerations .....	54
D.4.2.2	Several interferer within the same frequency range.....	54
D.4.2.3	Interferer overlapping in frequency range .....	54
D.4.2.4	Status of interferer .....	55
D.4.3	Kind of interferer signal .....	55
<b>Annex E (normative):</b>	<b>Definition of the representative test structure for TX measurements .....</b>	<b>56</b>
E.1	Attenuation of the TX-test structure.....	56
E.2	Procedure to measure the attenuation.....	57
E.3	Absorbing materials with lower attenuation.....	59
<b>Annex F (informative):</b>	<b>Bibliography.....</b>	<b>60</b>
<b>Annex G (informative):</b>	<b>Change history .....</b>	<b>61</b>
History .....		62

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# Foreword

This final 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 Vote phase of the ETSI Standardisation Request deliverable Approval Procedure (SRdAP).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.8] 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.6].

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, sub-part 1 of a multi-part deliverable covering Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised standard for access to radio spectrum, as identified below:

Part 1: "Generic UWB devices":

Sub-part 1: "Communication devices within 3,1 GHz to 4,8 GHz using LDC mitigation or within the 6 GHz to 8,5 GHz".

Part 2: "Ultra Wide Band location tracking devices":

Sub-part 1: "Requirements for devices within 6 GHz to 8,5 GHz";

Sub-part 2: "Requirements for devices in the frequency band between 3,1 GHz to 4,8 GHz utilizing LDC mitigation technique";

Sub-part 3: "Requirements for fixed infrastructure UWB based localization systems in the frequency band between 3,1 GHz to 4,8 GHz deploying Detect-And-Avoid (DAA) mitigation technique";



Sub-part 4: "Requirements for fixed outdoor devices within 6,0 GHz to 8,5 GHz";

Sub-part 5: "Requirements for enhanced indoor devices within 6,0 GHz to 8,5 GHz".

Part 3: "UWB devices installed in motor and railway vehicles":

Sub-part 1: "Requirements for UWB devices for vehicular access systems within 3,8 GHz to 4,2 GHz or 6 GHz to 8,5 GHz";

Sub-part 2: "Requirements for location tracking devices installed in rail and road vehicles operating in the frequency range of 3,1 GHz to 4,8 GHz or 6,0 GHz to 8,5 GHz";

Sub-part 3: "Requirements for UWB radiodetermination applications operating within 6,0 GHz to 8,5 GHz".

**Part 4: "Material Sensing devices":**

**Sub-part 1: "Building material analysis below 10,6 GHz";**

Sub-part 2: "UWB Material Sensing devices for Security Scanning";

Sub-part 3: "Ground humidity and condition sensor below 10,6 GHz";

Sub-part 4: "Exterior material sensing applications for ground based vehicles below 10,6 GHz";

Sub-part 5: "UWB surveillance devices for parking lot sensors below 10,6 GHz".

Part 5: "Devices using UWB technology onboard aircraft";

Part 6: "Ultra Wide Band radio-determination for radar sensing devices":

Sub-part 1: "Requirements for presence detection applications within 6,0 GHz to 8,5 GHz";

Sub-part 2: "Requirements for generic UWB through-air non-contact vital signs applications within 6,0 GHz to 8,5 GHz";

Sub-part 3: "Requirements for fixed outdoor presence detection devices within 6,0 GHz to 8,5 GHz";

Sub-part 4: "Requirements for fixed outdoor through-air non-contact vital signs applications within 6,0 GHz to 8,5 GHz";

Sub-part 5: "Requirements for enhanced indoor presence detection devices within 6,0 GHz to 8,5 GHz";

Sub-part 6: "Requirements for enhanced indoor through-air non-contact vital signs applications within 6,0 GHz to 8,5 GHz".

NOTE 1: The list above shows the planned multi-part deliverable, at the time, when the present document was finalized.

NOTE 2: Part 4, sub-parts 2 (UWB Material Sensing devices for Security Scanning), 3 (Ground humidity and condition sensor below 10,6 GHz) and 5 (UWB surveillance devices for parking lot sensors below 10,6 GHz) of this multi-part deliverable are under discussion (change WI) or will be stopped.

### 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

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## Modal verbs terminology

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## Introduction

For the present document, the applicable harmonised standard has been ETSI EN 302 065-4 [i.17] (Material Sensing devices using UWB technology below 10,6 GHz) which was published in the OJEU without restriction at 12 April 2017.

Since then ETSI ERM TGUWB decided to develop more specific standards; this means instead of one generic ETSI EN 302 065-4 [i.17] standard for UWB Material Sensing devices a standard family ETSI EN 302 065-4-x [i.17] for UWB Material Sensing devices was started. The present document is sub-part one (ETSI EN 302 065-4-1) of the new standard family.

More details on the changes of the present document to previous versions are provided in annex F.

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# 1 Scope

The present document specifies technical characteristics, limits and methods of measurements for Material Sensing devices for Building Material Analysis (BMA) below 10,6 GHz.

Additional details of the covered Building Material Analysis (BMA) devices can be found in clause 4.2 of the present document.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.6] is given in annex A.

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## 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 in the [ETSI docbox](#).

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 303 883-1 \(V2.1.1\) \(08-2024\)](#): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 1: Measurement techniques for transmitter requirements".
- [2] [ETSI EN 303 883-2 \(V2.1.1\) \(08-2024\)](#): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 2: Measurement techniques for receiver requirements".
- [3] [EN 520:2004 + A1:2009](#): "Gypsum plasterboards - Definitions, requirements and test methods", (produced by CEN).
- [4] [EN 10080:2005](#): "Steel for the reinforcement of concrete - Weldable reinforcing steel - General", (produced by CEN).
- [5] [EN 15497:2014](#): "Structural finger jointed solid timber - Performance requirements and minimum production requirements", (produced by CEN).
- [6] [ETSI TS 103 941 \(V.1.1.1\) \(01-2024\)](#): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Measurement setups and specifications for testing under full environmental profile (normal and extreme environmental conditions)".

## 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] [ECC/DEC/\(07\)/01](#): "ECC Decision of 30 March 2007 on the harmonised use, exemption from individual licensing and free circulation of Material Sensing Devices using Ultra-Wideband (UWB) technology, approved 30 March 2007, updated 1 July 2022".
- [i.2] [Commission Implementing Decision \(EU\) 2024/1467 of 27 May 2024](#) amending Implementing Decision (EU) 2019/785 on the harmonisation of radio spectrum for equipment using ultra-wideband technology in the Union.
- [i.3] [ERC/REC 70-03 \(8 March 2024\)](#): "ERC Recommendation of 1997 on relating to the use of Short Range Devices (SRD)".
- [i.4] [Commission Implementing Decision \(EU\) 2022/180 of 8 February 2022](#) amending Decision 2006/771/EC as regards the update of harmonised technical conditions in the area of radio spectrum use for short-range devices.
- [i.5] ETSI TR 102 495-1 (V1.1.1) (01-2006): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Technical characteristics for SRD equipment using Ultra Wide Band Sensor technology (UWB); System Reference Document Part 1: Building material analysis and classification applications operating in the frequency band from 2,2 GHz to 8 GHz".
- [i.6] [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.7] [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.8] [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.
- [i.9] Recommendation ITU-R SM.1755: "Characteristics of ultra-wideband technology".
- [i.10] ETSI TR 103 181-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB); Transmission characteristics Part 2: UWB mitigation techniques".
- [i.11] [EN 206:2013+A2:2021](#): "Concrete - Specification, performance, production and conformity", (produced by CEN).
- [i.12] ETSI TS 103 361 (V1.1.1): "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".
- [i.13] [ECC/DEC/\(20\)/01](#): "ECC Decision of 20 November 2020 on the harmonised use of the frequency band 5945-6425 MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN)".

- [i.14] ETSI TS 136 101 (V16.8.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101)".
- [i.15] ETSI EG 203 336 (V1.2.1): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.16] [ECO Frequency Information System](#).
- [i.17] ETSI EN 302 065-4 (V1.1.1): " 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".
- [i.18] ETSI TS 103 567 (V1.1.1): "Requirements on signal interferer handling".
- [i.19] Void.

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 303 883-1 [1], ETSI EN 303 883-2 [2], ETSI TS 103 941 [6] and the following apply:

**active mitigation techniques:** mitigation techniques, like listen before talk and detect and avoid

NOTE: For more details see ETSI TR 103 181-2 [i.10].

**material sensing devices for Building Material Analysis (BMA):** building material sensing devices which are designed to detect the location of objects within a building structure or to determine the physical properties of a building material

**measurement side:** side of the EUT which will be pointed to the material/building structure

**user side:** side of the EUT with the user interfaces to operate the EUT and to display the measurement results to the user

### 3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 303 883-1 [1], ETSI EN 303 883-2 [2] and the following apply:

$d, d_1, d_2$	Measurement distance
$d_{TXW}$	Thickness of the test wall
$f_1$	RBR test frequency within the middle of the EUT OFR
$f_2$	RBR test frequency between $f_L$ and $f_C$ of the EUT OFR
$f_3$	RBR test frequency between $f_C$ and $f_H$ of the EUT OFR
$f_C$	Centre frequency of the operating frequency range
$f_H$	Highest frequency of the operating frequency range
$f_{H1,2}$	RBR test frequency higher $f_H$ of the EUT OFR
$f_L$	Lowest frequency of the operating frequency range
$f_{L1,2}$	RBR test frequency lower $f_L$ of the EUT OFR
$f_{HS}$	Higher frequency border between OOB and spurious domain
$f_{LS}$	Lower frequency border between OOB and spurious domain
$g_{wall}$	Attenuation of the test structure for TX measurements; in [dB]
$P_{Thresh}$	Threshold for the duty cycle measurement
$R_{DR}$	Distance of the specified object within the RX-conformance test scenario for the RBR requirement
$R_{DS}$	Distance of the specified object within the RX-conformance test scenario for the RBS requirement
$th$	Reference point for the assessment of the power level at the EUT
$thl$	Assessed power levels for the LBT test
$TX1,2$	Categorization of BMA EUT by modulation

X	Parameter in dB to specify the OFR of the EUT in relation to the TX emission
X <sub>TXUE</sub>	Parameter in percentage to specify the OOB and spurious domain in relation to OFR of the EUT

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 303 883-1 [1], ETSI EN 303 883-2 [2] and the following apply:

BMA	Building Material Analysis
TXb	TX behaviour under the complete environmental profile
WTPC	Wanted Technical Performance Criteria

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## 4 Technical requirements specifications

### 4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use, but as a minimum, shall be that specified in the test conditions contained in the present document. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

### 4.2 EUT categories

#### 4.2.1 General

The present document covers Material Sensing devices for building material analysis operating below 10,6 GHz. This devices are named as Building Material Analysis (BMA) EUT.

More details about the use-case, wanted technical performance criteria and the RX-requirements and test conditions of the BMA devices is provided in annex C.

The specified BMA EUT categories provide a clear classification for the wanted technical performance criteria, limits requirements and conformance test procedures.

The following criteria were considered for categorization of the EUT covered by the present document:

- Regulation: ECC and EC recommendations and decisions, see clause 4.2.2
- Modulation: kind of modulation of the TX signal, see clause 4.2.3
- Usage of active UWB mitigation techniques (e.g. LBT, DAA), see clause 4.2.4

An overview of the covered EUT categories is provided in clause 4.2.5, table 1a and table 1b.

#### 4.2.2 Categorization by Regulation

The following regulations were considered for categorization of BMA EUT:

- SRD regulations for EUT based on narrowband technologies:
  - 2 400-2 483,5MHz: ERC/REC 70-03 annex 6, band c [i.3] and 2022/180/EU band 57b [i.4]
  - 5 725-5 875 MHz: ERC/REC 70-03 annex 1, band j [i.3] and 2022/180/EU band 61 [i.4].
- UWB regulations for EUT based on UWB technologies: contact based UWB material sensing devices according to ECC/DEC/(07)01 [i.1] and Decision (EU) 2024/1467 [i.2] for BMA EUT based on UWB technology with or without active mitigation techniques.

### 4.2.3 Categorization by Modulation

The following categorization of BMA EUT by modulation (see ETSI EN 303 883-1 [1], annex C) is done for UWB technology only (UWB regulation) due to the different consideration of the modulation in measurement procedures:

- TX1: EUT with FHSS, sequential hopping/stepping or FMCW modulation.
- TX2: for EUT with any other modulation different from TX1.

### 4.2.4 Categorization by Active Mitigation Techniques

BMA EUT covered by ECC/DEC/(07)01 [i.1] and Decision (EU) 2024/1467 [i.2] are categorized by the implementation of the active mitigation techniques "Listen Before Talk" (LBT):

- BMA EUT based on UWB technology without LBT active mitigation technique.
- BMA EUT based on UWB technology with LBT active mitigation technique.

### 4.2.5 Summary EUT categories

5 EUT categories are following from the above categorization:

- BMA1: based on narrowband technologies (SRD regulations)
- BMA2: based on UWB technology without active mitigation techniques using TX1 (UWB regulations)
- BMA3: based on UWB technology without active mitigation techniques using TX2 (UWB regulations)
- BMA4: based on UWB technology with active mitigation techniques using TX1 (UWB regulations)
- BMA5: based on UWB technology with active mitigation techniques using TX2 (UWB regulations)

An overview of requirements for each EUT categories is given in:

- table 1a for EUT category based on SRD regulation; and
- table 1b for EUT categories based on UWB regulation.

**Table 1a: EUT categories based on SRD regulation covered by ERC/REC 70-03 [i.3] and 2022/180/EU [i.4]**

Category	Modulation	TX requirements		RX-requirements	
		Emission requirements			
			Clause		Clause
BMA1	TX1 & TX2	OFR	4.3.2	TWPC	C.2.1
		Mean e.i.r.p.	4.3.3	RBS	4.4.3 & C.2.2
		TXUE	4.3.5	RBR	4.4.4 & C.2.3
		TXb	4.3.9		

**Table 1b: EUT categories based on UWB regulation covered by ECC/DEC/(07)01 [i.1] and Decision (EU) 2024/1467 [i.2]**

Category	Modulation	TX requirements						RX-requirements	
		Emission requirements		Additional requirements		Active mitigation			Clause
			Clause		Clause		Clause		
EUT without any active mitigation technique									
BMA2	TX1	OFR	4.3.2	DC	4.3.8	Not applicable		TWPC	C.2.1
		Indirect emissions	4.3.4	TRP <sub>SD</sub>	4.3.6			RBS	4.4.3 & C.2.2
		TXUE	4.3.5	TXb	4.3.9			RBR	4.4.4 & C.2.3
BMA3	TX2	OFR	4.3.2	DC	4.3.8	Not applicable		TWPC	C.2.1
		Indirect emissions	4.3.4	TRP <sub>SD</sub>	4.3.6			RBS	4.4.3 & C.2.2
		TXUE	4.3.5	TXb	4.3.9			RBR	4.4.4 & C.2.3
EUT implemented the active mitigation technique LBT									
BMA4	TX1	OFR	4.3.2	DC	4.3.8	LBT	4.3.7	TWPC	C.2.1
		Indirect emissions	4.3.4	TRP <sub>SD</sub>	4.3.6			RBS	4.4.3 & C.2.2
		TXUE	4.3.5	TXb	4.3.9			RBR	4.4.4 & C.2.3
BMA5	TX2	OFR	4.3.2	DC	4.3.8	LBT	4.3.7	TWPC	C.2.1
		Indirect emissions	4.3.4	TRP <sub>SD</sub>	4.3.6			RBS	4.4.3 & C.2.2
		TXUE	4.3.5	TXb	4.3.9			RBR	4.4.4 & C.2.3

## 4.3 Transmitter requirements

### 4.3.1 General

Based on the different possible TX signal modulations for the EUT categories covered by the present documents there are different related conformance test- set-ups necessary. The different categories of EUT (see clause 4.2) require different test setups due to different modulation techniques. Clause 5 elaborates on these differences.

The transmitter requirements for all EUT categories covered by the scope of the present document are justified in annex B, table B.1.

### 4.3.2 Operating Frequency Range (OFR)

#### 4.3.2.1 Applicability

The Operating Frequency Range (OFR) requirement applies to all EUT categories, see clause 4.2.5, table 1a and table 1b.

#### 4.3.2.2 Description Operating Frequency Range

For the description of the Operating Frequency Range (OFR), see ETSI EN 303 883-1 [1], clause 5.2.1.

According to ETSI EN 303 883-1 [1], clause 5.2.1 the limit for the parameter X for the BMA1 category (see clause 4.2.5, table 1a) is specified to:

X:	23
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According to ETSI EN 303 883-1 [1], clause 5.2.1 the limit for the parameter X for the - BMA2, BMA3, BMA4 and BMA5 categories (see clause 4.2.5, table 1b) is specified to:

X:	10
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