



**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.....	7
Introduction	7
1 Scope	8
2 References	8
2.1 Normative references	8
2.2 Informative references.....	8
3 Definition of terms, symbols and abbreviations.....	10
3.1 Terms.....	10
3.2 Symbols.....	10
3.3 Abbreviations	10
4 Technical requirements specifications	11
4.1 Environmental profile.....	11
4.2 EUT categories.....	11
4.2.1 General.....	11
4.2.2 Categorization by Regulation	11
4.2.3 Categorization by Modulation	11
4.2.4 Categorization by Active Mitigation Techniques	12
4.2.5 Summary BMA EUT sub-categories	12
4.3 Transmitter requirements	13
4.3.1 General.....	13
4.3.2 Operating Frequency Range (OFR).....	13
4.3.2.1 Applicability.....	13
4.3.2.2 Description Operating Frequency Range	13
4.3.2.3 Limits for Operating Frequency Range.....	13
4.3.2.3.1 Limit requirement for BMA based on UWB regulations	13
4.3.2.3.2 Limit requirement for BMA based on SRD regulations	14
4.3.2.4 Conformance.....	14
4.3.3 Mean e.i.r.p.....	14
4.3.3.1 Applicability.....	14
4.3.3.2 Description Mean e.i.r.p.....	14
4.3.3.3 Limits for Mean e.i.r.p.	14
4.3.3.4 Conformance.....	14
4.3.4 Indirect Emissions	15
4.3.4.1 Applicability.....	15
4.3.4.2 Description Indirect Emission.....	15
4.3.4.3 Limits for Indirect Emission	15
4.3.4.3.1 Limits for Indirect Emissions for BMA sub-categories BMA2 and BMA3	15
4.3.4.3.2 Indirect Emissions for BMA sub-categories BMA4 and BMA5	16
4.3.4.4 Conformance.....	17
4.3.5 TX Unwanted Emissions (TXUE).....	17
4.3.5.1 Applicability.....	17
4.3.5.2 Description TX unwanted emissions.....	17
4.3.5.3 Limits for TXUE.....	18
4.3.5.3.1 TXUE limit for BMA sub-category BMA1.....	18
4.3.5.3.2 TXUE limit for BMA sub-categories BMA2, BMA3, BMA4 and BMA5	18
4.3.5.4 Conformance.....	18
4.3.6 Total Radiated Mean e.i.r.p Spectral Density (TRP _{SD}).....	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.....	19
4.3.6.3.1 TRP _{SD} limit for BMA sub-categories BMA2 and BMA3	19
4.3.6.3.2 TRP _{SD} limit for BMA sub-categories BMA4 and BMA5	19

4.3.6.4	Conformance	19
4.3.7	Listen Before Talk (LBT)	20
4.3.7.1	Applicability	20
4.3.7.2	Description of Listen Before Talk	20
4.3.7.3	Limits for Listen Before Talk	20
4.3.7.4	Conformance	20
4.3.8	Duty Cycle	20
4.3.8.1	Applicability	20
4.3.8.2	Description of Duty Cycle	21
4.3.8.3	Limits for Duty Cycle	21
4.3.8.4	Conformance	21
4.3.9	TX behaviour under the complete environmental profile (TXb)	21
4.3.9.1	Applicability	21
4.3.9.2	Description	21
4.3.9.3	Limits for radiated assessment of the TX behaviour	22
4.3.9.4	Conformance	22
4.4	Receiver requirements	22
4.4.1	General	22
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	23
4.4.4	Receiver Baseline Resilience (RBR)	23
4.4.4.1	Applicability	23
4.4.4.2	Description for the RBR requirement	23
4.4.4.3	Limits	23
4.4.4.4	Conformance	23
5	Testing for compliance with technical requirements	23
5.1	Environmental conditions for testing	23
5.1.1	General	23
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	24
5.2.1	General	24
5.2.2	Disregard time (T_{dis})	24
5.2.3	Threshold - level (P_{thresh})	24
5.2.4	EUT orientation and reference points	25
5.2.5	Test scenarios and setup for transmitter conformance tests	25
5.2.5.1	For BMA sub-category BMA1	25
5.2.5.2	For BMA sub-categories BMA2, BMA3, BMA4 and BMA5	26
5.3	Conformance methods of measurement for TX requirements	27
5.3.1	Operating Frequency Range (OFR)	27
5.3.1.1	OFR assessment parameter X	27
5.3.1.2	OFR conformance test BMA sub-category BMA1	27
5.3.1.3	OFR conformance test BMA sub-categories BMA2, BMA3, BMA4 and BMA5	27
5.3.2	Mean e.i.r.p.	28
5.3.3	Indirect emissions	29
5.3.4	TX unwanted emissions	30
5.3.4.1	General	30
5.3.4.2	TXUE conformance test for BMA sub-category BMA1	31
5.3.4.3	TXUE conformance test for BMA sub-categories BMA2, BMA3, BMA4 and BMA5	31
5.3.5	Total Radiated Mean e.i.r.p Spectral Density (TRP_{SD})	32
5.3.6	Listen Before Talk (LBT)	32
5.3.7	Duty Cycle	33
5.3.8	TX behaviour under the complete environmental profile	34
5.3.8.1	General	34
5.3.8.2	Conformance test procedures	35
5.3.8.2.1	Conformance test procedure for BMA1	35
5.3.8.2.2	Conformance test procedure for BMA2, BMA3, BMA4 and BMA5	35

5.4	Conformance methods of measurement for receiver.....	35
5.4.1	General for RBS and RBR conformance tests.....	35
5.4.2	Receiver Baseline Sensitivity (RBS).....	36
5.4.2.1	RBS test for BMA category.....	36
5.4.3	Receiver Baseline Resilience (RBR).....	37
5.4.3.1	RBR test for BMA category.....	37
Annex A (informative):	Relationship between the present document and the essential requirements of Directive 2014/53/EU.....	39
Annex B (informative):	Selection of technical parameters.....	41
Annex C (normative):	BMA Category: Use-Case, wanted technical performance criteria and RX-test conditions.....	44
C.1	Description.....	44
C.2	Wanted Technical Performance Criteria (WTPC) and RX - requirement.....	44
C.2.1	General.....	44
C.2.2	RBS-requirement and limit.....	44
C.2.3	RBR requirement and limit.....	45
C.3	Test-wall for RX-Measurement.....	45
C.3.1	Description test-wall for RX-measurement.....	45
C.3.2	Technical Details for RX Test-wall.....	46
C.3.2.1	Specification of the Gypsum board.....	46
C.3.2.2	Specification of the Rebar.....	46
C.3.2.3	Specification of the Wood Frame.....	46
Annex D (normative):	Interferer for RBR test.....	47
D.1	Interferer requirements for RBR tests.....	47
D.1.1	General test frequencies for RBR tests.....	47
D.1.2	Test frequencies for EUT with OFR < 500 MHz.....	47
D.1.3	Test frequencies for EUT with OFR ≥ 500 MHz.....	48
D.1.4	Interferer power levels and modulation.....	48
D.2	Interferer test signals for BMA sub-category BMA1.....	50
D.3	Interferer test signals for BMA sub-category BMA2, BMA3, BMA4 and BMA5.....	50
D.3.1	Interferer test signals.....	50
D.3.2	Assessment if no interferer test signal provided at calculated test frequency.....	51
D.4	List of interferer for RBR test; assessment procedure.....	53
D.4.1	General.....	53
D.4.2	Assessment list of relevant interferer.....	53
D.4.2.1	Basic considerations.....	53
D.4.2.2	Several interferer within the same frequency range.....	53
D.4.2.3	Interferer overlapping in frequency range.....	54
D.4.2.4	Status of interferer.....	54
D.4.3	Kind of interferer signal.....	54
Annex E (normative):	Definition of the representative test structure for TX measurements.....	55
E.1	Attenuation of the TX-test structure.....	55
E.2	Procedure to measure the attenuation.....	56
E.3	Absorbing materials with lower attenuation.....	58
Annex F (informative):	Change history.....	59
History	60

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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 Standardisation Request deliverable Approval Procedure.

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. Full details of the entire series can be found in part 3, sub-part 1 [i.20].

Proposed national transposition dates	
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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.6].

For the case of the present document, the applicable harmonised standard has been ETSI EN 302 065-4 [i.17], for 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 will be 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 and methods of measurements for Material Sensing devices for Building Material Analysis (BMA) below 10,6 GHz.

Further details of the covered Building Material Analysis (BMA) 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.

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

- [1] [ETSI EN 303 883-1 \(V2.1.1\) \(2024-06\)](#): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 1: Measurement techniques for transmitter requirements".
- [2] [ETSI EN 303 883-2 \(V2.1.1\) \(2024-06\)](#): "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 CENELEC).
- [6] [ETSI TS 103 941 \(V.1.1.1\)](#): "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.

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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] DIN EN 206:2013+A1:2016/prA2:2020: "Concrete - Specification, performance, production and conformity"; German and English version.
- [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] [ECC/DEC\(06\)04](#): "ECC/DEC/(06)04 of 24 March 2006 on the harmonised use, exemption from individual licensing and free circulation of devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz", latest amended on 18 November 2022.

- [i.20] ETSI EN 302 065-3-1 (V3.1.1): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised standard for access to radio spectrum; 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".

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
$TX_{1,2}$	categorization of BMA EUT by modulation
X	parameter in dB to specify the OFR of the EUT in relation to the TX emission
X_{TXUE}	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

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. 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 below 10,6 GHz. This category is 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 category is provided in annex C.

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

The following criteria were considered for sub-categorization of BMA category:

- 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 BMA EUT sub-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 sub-categorization of BMA EUT:

- SRD regulations 2 400-2 483,5MHz: ERC/REC 70-03 annex 6, band c [i.3] and 2022/180/EU band 57b [i.4] for BMA EUT based on narrowband technologies.
- UWB regulations: 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 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 active mitigation techniques of LBT.
- BMA EUT based on UWB technology with active mitigation techniques of LBT.

4.2.5 Summary BMA EUT sub-categories

5 sub-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 BMA EUT sub-categories is given in:

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

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

Sub-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: BMA EUT based on UWB regulation covered by ECC/DEC/(07)01 [i.1] and Decision (EU) 2024/1467 [i.2]

Sub-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 _{SD}	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 _{SD}	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 _{SD}	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

Sub-category	Modulation	TX requirements				RX-requirements		
		Emission requirements		Additional requirements		Active mitigation		
			clause		clause		clause	
		Indirect emissions	4.3.4	TRP _{SD}	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 a 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 BMA sub-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

This requirement applies to all BMA sub-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 EUT covered by the sub-category BMA1 (see clause 4.2.5, table 1a) is:

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 EUT covered by the sub-category BMA2, BMA3, BMA4 and BMA5 (see clause 4.2.5, table 1b) is specified to:

X:	10
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NOTE: The specification of the parameter X for sub-categories BMA2, BMA3, BMA4 and BMA5 is in accordance with the -10 dB bandwidth for UWB EUT below 10 GHz, as defined in annex 1 of Recommendation ITU-R SM.1755 [i.9].

4.3.2.3 Limits for Operating Frequency Range

4.3.2.3.1 Limit requirement for BMA based on UWB regulations

The OFR for the BMA sub-categories BMA2, BMA3, BMA4 and BMA5 (see clause 4.2.5, table 1b) shall be in the permitted frequency range as given in table 2a and the OFR shall be equal or larger than 50 MHz.

Table 2a: Permitted frequency range for EUT based on Decision (EU) 2024/1467 [i.2]

Transmit	$30 \text{ MHz} \leq f \leq 10,6 \text{ GHz}$
Receive	$30 \text{ MHz} \leq f \leq 10,6 \text{ GHz}$

4.3.2.3.2 Limit requirement for BMA based on SRD regulations

The OFR for the BMA sub-category BMA1 (see clause 4.2.5, table 1a) shall be in the permitted frequency range as given in table 2b.

Table 2b: Permitted frequency range EUT based on 2022/180/EU [i.4]

Transmit	$2,4 \text{ GHz} \leq f \leq 2,4835 \text{ GHz}$
	$5,725 \text{ GHz} \leq f \leq 5,875 \text{ GHz}$
Receive	$2,4 \text{ GHz} \leq f \leq 2,4835 \text{ GHz}$
	$5,725 \text{ GHz} \leq f \leq 5,875 \text{ GHz}$

4.3.2.4 Conformance

The conformance test shall be done under normal conditions as defined in clause 5.1.2; the conformance test suite for OFR shall be as defined in clause 5.3.1.

4.3.3 Mean e.i.r.p.

4.3.3.1 Applicability

This requirement applies to the following BMA sub-category of:

- BMA1, see clause 4.2.5, table 1a.

NOTE: This is not applicable for equipment based on the UWB regulation (see table 1b), because such equipment is only allowed to be used in contact to a wall/or a material under investigation. Emission requirements for equipment based on the UWB regulation are in clause 4.3.4 on "indirect emissions". Tests for such equipment are performed in contact with the material under investigation, see Commission Implementing Decision (EU) 2024/1467 [i.2].

4.3.3.2 Description Mean e.i.r.p.

For the description of the Mean e.i.r.p, see ETSI EN 303 883-1 [1], clause 5.3.1.1.

4.3.3.3 Limits for Mean e.i.r.p.

The limits for the mean e.i.r.p. requirement within the OFR, see table 3.

Table 3: Mean e.i.r.p. for BMA sub-category BMA1

Frequency Range [MHz]	Mean e.i.r.p. [mW]
$2\ 400 \leq f \leq 2\ 483,5$	25
$5\ 725 \leq f \leq 5\ 875$	25

4.3.3.4 Conformance

The conformance test shall be done under normal conditions as defined in clause 5.1.2; the conformance test suite for Mean e.i.r.p. shall be as defined in clause 5.3.2.