Draft ETSI EN 302 065-4-4 V2.0.0 (2025-03)

Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard for access to radio spectrum; Part 4: Material Sensing devices; Sub-part 4: Exterior material sensing applications for ground based vehicles below 10,6 GHz

Reference
REN/ERM-TGUWB-617

Keywords
automotive, harmonised standard, measurement, radiodetermination, SRD, UWB

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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 9
3.1 Terms 9
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 EVS EUT categories 12
4.3 Transmitter requirements 12
4.3.1 General 12
4.3.2 Operating Frequency Range (OFR) 13
4.3.2.1 Applicability 13
4.3.2.2 Description 13
4.3.2.3 Limits 13
4.3.2.4 Conformance 13
4.3.3 Indirect emissions 13
4.3.3.1 Applicability 13
4.3.3.2 Description 14
4.3.3.3 Limits for indirect emissions 14
4.3.3.3.1 EUT without any active mitigation techniques 14
4.3.3.3.2 EUT with active mitigation techniques 15
4.3.3.4 Conformance 15
4.3.4 TX Unwanted Emissions (TXUE) 15
4.3.4.1 Applicability 15
4.3.4.2 Description 15
4.3.4.3 Limits 16
4.3.4.4 Conformance 16
4.3.5 Total Radiated Power spectral density (TRP_{SD}) 16
4.3.5.1 Applicability 16
4.3.5.2 Description 16
4.3.5.3 Limits 16
4.3.5.3.1 Limits for EUT without active mitigation techniques 16
4.2.5.3.2 Limits for EUT with active mitigation technique 17
4.3.5.4 Conformance 17
4.3.6 Listen Before Talk (LBT) 17
4.3.6.1 Applicability 17
4.3.6.2 Description 17
4.3.6.3 Limits 18
4.3.6.4 Conformance 18
4.3.7 Duty Cycle 18
4.3.7.1 Applicability 18
4.3.7.2 Description 18

4.3.7.3 Limits 18
4.3.7.4 Conformance 19
4.3.8 TX behaviour under the complete environmental profile 19
4.3.8.1 Applicability 19
4.3.8.2 Description 19
4.3.8.3 Limits for conducted assessment of the TX behaviour 19
4.3.8.4 Conformance 20
4.4 Receiver conformance requirements 20
4.4.1 General 20
4.4.2 Wanted technical performance criteria 20
4.4.3 Receiver Dynamic Range (RDR) 20
4.4.3.1 Applicability 20
4.4.3.2 Description 20
4.4.3.3 Limits 20
4.4.3.4 Conformance 21
4.4.4 Receiver Baseline Resilience (RBR) 21
4.4.4.1 Applicability 21
4.4.4.2 Description 21
4.4.4.3 Limits 21
4.4.4.4 Conformance 21

5 Testing for compliance with technical requirements 21
5.1 Environmental conditions for testing 21
5.1.1 General 21
5.1.2 Normal test conditions 21
5.1.3 Complete environmental profile test conditions 22
5.2 General conditions for testing 22
5.3 Conformance test suites 22
5.3.1 General 22
5.3.2 EUT orientation and reference points 22
5.3.3 Test scenarios and setup for transmitter conformance tests 23
5.4 Conformance methods of measurement for transmitter 24
5.4.1 Operating Frequency Range (OFR) 24
5.4.2 Indirect emissions 25
5.4.2.1 General 25
5.4.2.2 Considerations for conformance tests for EUT without TRP_{SD} assessment 26
5.4.2.3 Considerations for conformance tests for EUT with TRP_{SD} assessment 26
5.4.2.4 Common conformance test procedure for TRP_{SD} 27
5.4.3 TX Unwanted Emissions 27
5.4.4 Total Radiated Power spectral density (TRP_{SD}) 27
5.4.5 Listen Before Talk (LBT) 28
5.4.6 Duty Cycle 28
5.4.7 Conducted measurements of indirect emissions under complete environmental profile 29
5.4.7.1 General 29
5.4.7.2 EUT with antenna connectors 29
5.5 Conformance methods of measurement for receiver 29
5.5.1 General for RDR and RBR conformance tests 29
5.5.2 Receiver Dynamic Range (RDR) 30
5.5.2.1 RDR test 30
5.5.3 Receiver Baseline Resilience (RBR) 31
5.5.3.1 RBR test 31

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU 33

Annex B (informative): Selection of technical parameters 35

Annex C (normative): Category non-contact-based ground analysing sensor devices 37

C.1 Description 37

C.2 Wanted Technical Performance Criteria (WTPC) and RX - requirement 37
C.2.1 Introduction 37

C.2.2 Performance criteria for EVS 37
C.2.3 Justification for missing RX requirements from ETSI EG 203 336 38
C.3 Reference ground and sand pit 39
C.4 Conductive metal plate for measurements 39
C.4.1 Dimensions of metal cover plate for measurement purposes 39
C.4.2 Measurement of resistance 39
C.5 General Measurement setup 39
Annex D (normative): Interferer for RBR test 41
D.1 Interferer requirements for RBR tests 41
D.1.1 General test frequencies for RBR tests 41
D.1.2 Test frequencies for EUT with OFR < 500 MHz 41
D.1.3 Test frequencies for EUT with OFR ≥ 500 MHz 42
D.1.4 Interferer power levels and modulation 42
D.2 Interferer test signals for EVS 43
D.2.1 Interferer test signals 43
D.2.2 Assessment if no interferer test signal provided at calculated test signals 44
D.3 List of interferer for RBR test; assessment procedure 45
D.3.1 General 45
D.3.2 Assessment list of relevant interferer 46
D.3.2.1 Considering 46
D.3.2.2 Several interferer within the same frequency range 46
D.3.2.3 Interferer overlapping in frequency range 46
D.3.2.4 Status of interferer 47
D.3.3 Kind of interferer signal 47
Annex E (informative): Change history 48
History 49

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI IPR online database.

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™**, **LTE™** and **5G™** logo are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

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 (SRdAP).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.5] 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.3].

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 4 of a multi-part deliverable. Full details of the entire series can be found in part 4, sub-part 1 [i.14].

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

ETSI TC ERM TGUWB decided to develop more specific standards; this means instead of one generic ETSI EN 302 065-4 [i.8] standard for UWB Material Sensing devices a standard family ETSI EN 302 065-4-x for UWB Material Sensing devices was started. The present document is sub-part 4 (ETSI EN 302 065-4-4) of the new standard family.

1 Scope

The present document specifies the technical requirements, limits and test methods for material sensing devices using UWB technology exterior material sensing devices for ground based vehicles below 10,6 GHz.

The present document only covers non-contact based UWB material sensing devices with antenna connectors according to ECC/DEC(07)01 [i.1] and Commission Decision 2024/1467/EU [i.2].

Further details of the covered EUT for external material sensing applications for ground-based vehicles and the related categories 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.3] 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.

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] ETSI EN 302 066 (V2.2.1) (06-2020): "Short Range Devices (SRD); Ground- and Wall- Probing Radio determination (GPR/WPR) devices; Harmonised Standard for access to radio spectrum".

[4] ETSI TS 103 941 (V1.1.1) (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", amended on 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] 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.4] 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.5] 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.6] Recommendation ITU-R SM.1755: "Characteristics of ultra-wideband technology".

[i.7] ETSI EG 203 336 (V1.2.1) (2020-05): "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.8] 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.9] 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.10] 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.11] 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".

[i.12] ECO Frequency Information System.

[i.13] ETSI TS 103 567 (V1.1.1): "Requirements on signal interferer handling".

[i.14] ETSI EN 302 065-4-1: "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 operating within 30 MHz to 10,6 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] and the following apply:

footsize: outside dimension of the EUT in the horizontal plane

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:

c	Velocity of light in a vacuum
d, d_1,d_2	Measurement distance
D_1	Difference between *M* and *N*
D_2	Difference between *M* and *I*
d_{int}	Interferer distance
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_M	Frequency at which the peak power emission occurs
$G_{(f)}$	Antenna gain over frequency
G_A	Gain of the measurement antenna
I	Signal recorded by the receiver in presence of the interferer
M	Maximum signal for the receiver in the linear region of operation
N	Receiver noise level
$P_{e.i.r.p.}$	Spectral power density
R	Distance
TRP_{SD}	Total Radiated Power spectral density

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:

BBDR	BroadBand Disaster Relief
BFWA	Broadband Fixed Wireless Access
BS	Base Station
CDMA	Code Division Multiple Access
CW	Continuous Wave
dB	decibel
dBm	decibel reference to 1 mW
DCS	Digital Cellular System
e.i.r.p.	equivalent isotropic radiated power
EC	European Commission
EN	European Norm
E-UTRA	Evolved Universal Terrestrial Radio Access
EVS	External Vehicular Sensor
FDD	Frequency Division Duplex
FHSS	Frequency Hopping Spread Spectrum
GSM	Global System for Mobile
IMT	International Mobile Telecommunications
ITS	Intelligent Transport Systems
LBT	Listen Before Talk
LTE	Long Term Evolution
PCS	Personal Communication System
PMSE	Programme Making and Special Events
PPDR	Public Protection and Disaster Relief
RDR	Receiver Dynamic Range
RFID	Radio Frequency IDentification
RLAN	Radio Local Area Network
T-DAB	Terrestrial - Digital Audio Broadcast
TH	ThresHold

TRP	Total Radiated Power
TS	Technical Specification
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
WIMAX®	Worldwide Interoperability for Microwave Access
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, 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 one category of EUT for exterior material sensing applications at ground based vehicle below 10,6 GHz. This category is named as Exterior Vehicle Sensors (EVSs).

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

The specified EVS 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 EVS 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 EVS EUT sub-categories is provided in clause 4.2.5, table 1.

4.2.2 Categorization by Regulation

The following regulation was considered for sub-categorization of EVS EUT:

- UWB regulations: ECC/DEC/(07)01 [i.1] and Decision (EU) 2024/1467 [i.2] for EVS EUT based on UWB technology with or without active mitigation techniques.

4.2.3 Categorization by Modulation

The following categorization of EVS EUT by modulation is used:

- TX1: for 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] can be categorized by use of active mitigation techniques (e.g. Listen Before Talk (LBT), Detect-and-Avoid (DAA)):

- EVS EUT based on UWB technology without active mitigation techniques.
- EVS EUT based on UWB technology with active mitigation techniques.

4.2.5 Summary EVS EUT categories

4 sub-categories of the EVS EUT are identified:

- EVS1: based on UWB technology without active mitigation techniques using TX1 (UWB regulations).
- EVS2: based on UWB technology without active mitigation techniques using TX2 (UWB regulations).
- EVS3: based on UWB technology with active mitigation techniques using TX1 (UWB regulations).
- EVS4: based on UWB technology with active mitigation techniques using TX2 (UWB regulations).

An overview of requirements for each EVS EUT categories is given in table 1.

Table 1: EVS EUT categories covered by the present document

Category	Modulation	TX requirements						RX-requirements	
		Emission requirements		Additional requirements		Active mitigation			
			Clause		Clause		Clause		Clause
EUT based UWB regulation; EUT without any active mitigation technique									
EVS1	TX1	OFR	4.3.2	DC	4.3.7			WTPC	C.2
		Indirect emissions	4.3.4	TRP	4.3.5			RBS	4.4.3
		TXUE	4.3.5					RBR	4.4.4
EVS2	TX2	OFR	4.3.2	DC	4.3.7			WTPC	C.2
		Indirect emissions	4.3.4	TRP	4.3.5			RBS	4.4.3
		TXUE	4.3.5					RBR	4.4.4
EUT based UWB regulation; EUT implemented the active mitigation technique LBT									
EVS3	TX1	OFR	4.3.2	DC	4.3.7	LBT	4.3.6	WTPC	C.2
		Indirect emissions	4.3.4	TRP	4.3.5			RBS	4.4.3
		TXUE	4.3.5					RBR	4.4.4
EVS4	TX2	OFR	4.3.2	DC	4.3.7	LBT	4.3.6	WTPC	C.2
		Indirect emissions	4.3.4	TRP	4.3.5			RBS	4.4.3
		TXUE	4.3.5					RBR	4.4.4

4.3 Transmitter requirements

4.3.1 General

Based on the different possible operational frequency ranges of the EUT categories covered in the present document different sets of transmitter conformance requirements are applicable. The applicability is governed by the operating frequency range as specified in clause 4.3.2.