ETSI EN 302 065-3-1 V3.2.1 (2025-02)

**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**

Reference
REN/ERM-TGUWB-150-3-1

Keywords
harmonised standard, SRD, UWB

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Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

The present document is part 3, 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 operating within 30 MHz to 10,6 GHz";

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

Sub-part 3: "Ground humidity and condition sensor;

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.

National transposition dates	
Date of adoption of this EN:	18 February 2025
Date of latest announcement of this EN (doa):	31 May 2025
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 2025
Date of withdrawal of any conflicting National Standard (dow):	30 November 2026

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

For the present document, the applicable harmonised standard has been ETSI EN 302 065-3 [i.12], for UWB devices for ground based vehicular applications, which was published in the OJEU without restriction at 10 March 2017 [i.9] and then published at 5 February 2020 [i.10] with the following restriction:

- *"This harmonised standard does not set out technical specifications for 'trigger before-transmit techniques'. Implementing Decision (EU) 2019/785, however, imposes, as of 16 November 2019, technical requirements to be used within the bands 3,8-4.2 GHz and 6-8,5 GHz for vehicular access systems using trigger-before transmit. Therefore, compliance with this harmonised standard does not ensure compliance with Decision (EU) 2019/785 and accordingly does not confer a presumption of conformity with those essential requirements set out in Article 3 (2) of Directive 2014/53/EU which relate to 'trigger-before-transmit techniques'".*

In order to consider the above points, ETSI ERM TGUWB decided to develop more specific standards; for the present document this means instead of a generic ETSI EN 302 065-3 [i.12] standard for all road and rail vehicles applications, an ETSI EN 302 065-3-1 for UWB devices for vehicular access systems. Other sub-parts for UWB devices installed in motor and railway vehicles may follow (ETSI EN 302 065-3-x).

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

1 Scope

The present document specifies technical requirements, limits and test methods for equipment employing UWB for vehicular access devices installed in motor and railway vehicles in the frequency ranges 3,8 GHz to 4,2 GHz and 6,0 GHz to 8,5 GHz.

These equipment types are intended to be utilized for vehicle access, vehicle immobilization and extended vehicle access control functionalities (like closing windows or remotely starting the car).

Further details of the covered EUT can be found in clause 4.2.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] 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 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] 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 (RE-Directive).

[i.2] 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.3] ETSI TR 103 416 (V1.1.1) (07-2016): "System Reference document (SRdoc); Short Range Devices (SRD) using Ultra Wide Band (UWB); Technical characteristics and spectrum requirements for UWB based vehicular access systems for operation in the 3,4 GHz to 4,8 GHz and 6 GHz to 8,5 GHz frequency ranges".

[i.4] ECC/DEC/(06)04: "ECC Decision 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 (ECC Decision (06)04), amended on 6 July 2007, amended 9 December 2011, amended on 8 March 2019 and amended 18 November 2022".

[i.5] 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.6] ECC Report 278 (27 April 2018): "Specific UWB applications in the band 3.4-4.8 GHz and 6.0-8.5 GHz: Location tracking and sensor applications (LTA) for vehicular access systems".

[i.7] 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.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.

[i.9] Official Journal of the European Union, 13.7.2018: "Commission communication in the framework of the implementation of Directive 1999/5/EC of the European Parliament and of the Council on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity and Directive 2014/53/EU of the European Parliament and of the Council 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.10] Commission Implementing Decision (EU) 2020/167 of 5 February 2020 on the harmonised standards for radio equipment drafted in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.11] 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.12] ETSI EN 302 065-3 (V2.1.1): "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 3: Requirements for UWB devices for ground based vehicular applications".

[i.13] 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.14] ETSI TS 103 567 (V1.1.1): "Requirements on signal interferer handling".

[i.15] ERC Recommendation 74-01: "Unwanted emissions in the spurious domain", Approved 1998, Corrected 23 May 2022.

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:

control equipment: equipment capable of sending control messages to the EUT, as well as receiving responses to that control command or other status messages, in order to setup the EUT and perform a measurement procedure

control message: one or more commands used to control or configure the EUT

NOTE: Typically submitted on a specific, non-UWB control interface, like CAN-bus interface.

EUT trigger event: trigger event on EUT level

NOTE: Which is used for measurement procedures in the present document.

initiator: EUT role in an UWB transmission sequence in which the EUT initiates UWB transmission upon a system trigger event

NOTE: For more details see clause 4.3.7.2.

message: sequence or exchange of two or more packets in order to transfer information, in particular to generate a ranging information

NOTE: Time-of-Flight between EUT and companion device.

packet: used to refer to an UWB data frame or aggregated pulse sequence, that is sent over the air

NOTE: Typically, one packet represents a continuous T_{on} time.

receiver spurious emissions: receiver unwanted emissions that emanate from the EUT

NOTE: Receiver spurious emissions are generated internally by the receiver or result from the interaction of the RX coupling with the TX signal.

responder: EUT role in an UWB transmission sequence in which the EUT responds to an UWB transmission

NOTE: Typically an UWB transmission is a received UWB packet (for more details see clause 4.3.7.2.).

system trigger event: trigger event on system level

NOTE: Usually out of scope for EUT.

Time-of-Flight (ToF): travel time of the radio signal between transmitter and receiver

Trigger-Before-Transmit (TBT): mitigation technique as required for vehicular access systems

NOTE: See ECC/DEC/(06)04 [i.4].

vehicle transceiver: UWB enabled unit, installed in the vehicle

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	Measurement distance from the EUT to the test/measurement antenna
D	Recommended measurement distance for the Receiver Baseline Sensitivity (RBS) test
d_g	Sensitivity degradation
delta Θ	Delta of the elevation angle Θ
delta Φ	Delta of the azimuth angle Φ

f_c	Centre frequency of wanted signal
f_H	Highest frequency of the operating frequency range
f_L	Lowest frequency of the operating frequency range
F_{LOWER}	Lower frequency for the spurious emissions test
F_{UPPER}	Upper frequency for the spurious emissions test
OFR_{max}	Maximum possible Operating Frequency Range (OFR)
$P_{@EUT}$	Sensitivity @ EUT
P_{max}	Maximum signal level in duty-cycle measurement
P_{thres}	Threshold level
s	Second (unit)
t_{high}	Highest temperature
t_{low}	Lowest temperature
t_{steps}	Temperature steps for TX behaviour under the complete environment
T_{cease}	Cease time, until a transmitter ceases transmission after a trigger event
T_{dis}	Disregard time
T_{obs}	Observation time
T_{off}	Time interval between two consecutive bursts when the UWB emission is kept idle
T_{on}	Duration of a burst irrespective of the number of pulses contained
T_{on_cum}	cumulated Ton time
$T_{off\ mean}$	Mean T_{off}
$T_{on\ max}$	Maximum T_{on} time
$TBT_{timeout}$	Trigger-Before-Transmit timeout (cease time after EUT trigger)
$TBT_{On\text{-}Time}$	Trigger-Before-Transmit On-Time within any 10 s window after first EUT trigger
X	Parameter to specify the OFR of the emission
X_{TXUE}	Boundary value for determination of spurious domain

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:

BLE	Bluetooth® Low Energy
BW	BandWidth
CW	Continuous Wave
DC	Duty Cycle
EC	European Commission
ECC	European Communication Committee
EFTA	European Free Trade Association
EIRP	Equivalent Isotropically Radiated Power
EN	European Norm
ERM	Electromagnetic compatibility and Radio spectrum Matters
EG	ETSI Guide
ETSI	European Telecommunications Standards Institute
EU	European Union
EUT	Equipment Under Test
ID	IDentification
LDC	Low Duty Cycle
MSR	Message Success Rate
NFC	Near Field Communication
NLOS	Non Line Of Sight
OFR	Operating Frequency Range
OJEU	Official Journal of the European Union
OOB	Out Of band
RBR	Receiver Baseline Resilience
RBS	Receiver Baseline Sensitivity
RBW	Resolution BandWidth
RF	Radio Frequency
RLAN	Radio Local Area Network
RMS	Root Mean Square
RP	Radiated Power
RSE	Receiver Spurious Emission

RTTE	Radio and Telecommunications Terminal Equipment (Directive 1999/5/EC)
RX	Receiver
SRD	Short Range Device
TBT	Trigger-Before-Transmit
TG	Task Group
TGUWB	Task Group Ultra Wide Band
ToF	Time-of-Flight
TR	Technical Report
TS	Technical Specification
TX	Transmitter
TXUE	Transmitter Unwanted Emission
UWB	Ultra Wide Band
VBW	Video BandWidth
VLP	Very Low Power
WAS	Wireless Access Systems

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 Type of equipment and EUT categories

4.2.1 Type of equipment

Following types of equipment are covered by the present document:

1) Type 1 equipment: Vehicle transceivers, which meet the conditions below:
   a) Vehicle transceivers communicate on a "trigger-before-transmit" basis with:
      i) vehicle ID devices (Type 2 equipment); and/or
      ii) other vehicle transceivers (Type 1 equipment) in the same car; and/or
      iii) other UWB devices (e.g. smartphones).
   b) Vehicle transceivers are intended to be installed in the vehicle.
   c) Vehicle transceivers are capable of operating in the permitted frequency range as specified in Table 3.
   d) Based on regulation ECC/DEC/(06)04 [i.4], chapter A1.2.2 (Specific vehicular access systems using trigger-before-transmit) and Decision (EU) 2024/1467 [i.7], annex 3.2.
2) Type 2 equipment: Vehicle ID devices (e.g. key fobs), which meet the conditions below:
   a) Vehicle ID devices are handheld devices.
   b) Vehicle ID devices have bidirectional communication via UWB with vehicle transceivers (Equipment Type 1) for ranging purpose.
   c) Vehicle ID devices are paired with one specific vehicle and are an accessory to this vehicle.
   d) Vehicle ID devices are capable of operating in the permitted frequency range as specified in Table 3.

e) Based on regulation ECC/DEC/(06)04 [i.4], chapter A1.1 (General case) and Decision (EU) 2024/1467 [i.7], annex 1.

f) Type 2 equipment needs to be further categorized with respect to its duty cycle requirement in the frequency range 3,8 GHz to 4,2 GHz, see Table 1a.

Table 1a: EUT categories for Type 2 equipment (vehicle ID devices)

Type 2 Equipment	Frequency range	Duty cycle requirement
Category 2A	3,8 GHz to 4,2 GHz	See clause 4.3.6
Category 2B	6 GHz to 8,5 GHz	Not applicable

NOTE: The requirements in the present document apply to individual transceivers (Type 1 or Type 2 equipment) and not to combinations with a vehicle or devices.

4.2.2 EUT categories for Type 1 equipment (vehicle transceivers)

Type 1 equipment is further categorized with respect to its trigger scenario, see Table 1b:

Table 1b: EUT categories for Type 1 equipment (vehicle transceivers)

Type 1 equipment	Trigger scenario
Category 1A	Trigger scenario 1, see clause 4.3.7.2.4
Category 1B	Trigger scenario 2, see clause 4.3.7.2.5

4.2.3 Summary of EUT categories

An overview of requirements for each equipment type and EUT category is given in Table 2.

Table 2: EUT categories according to ECC/DEC/(06)01 [i.4] and Decision (EU) 2024/1467 [i.7]

EUT category	Frequency range	TX requirements Emission requirements		RX-requirements	
			Clause		Clause
1A	3,8 GHz < f ≤ 4,2 GHz or 6,0 GHz < f ≤ 8,5 GHz	OFR	4.3.2	RSE	4.4.3
		Mean e.i.r.p. spectral density	4.3.3	RBS	4.4.4
		Peak e.i.r.p. spectral density	4.3.4	RBR	4.4.5
		TX unwanted emissions	4.3.5		
		Duty Cycle	4.3.6		
		Trigger-before-transmit	4.3.7.2.4		
		TX behaviour in the complete environmental profile	4.3.8		
1B	3,8 GHz < f ≤ 4,2 GHz or 6,0 GHz < f ≤ 8,5 GHz	OFR	4.3.2	RSE	4.4.3
		Mean e.i.r.p. spectral density	4.3.3	RBS	4.4.4
		Peak e.i.r.p. spectral density	4.3.4	RBR	4.4.5
		TX unwanted emissions	4.3.5		
		Duty Cycle	4.3.6		
		Trigger-before-transmit	4.3.7.2.5		
		TX behaviour in the complete environmental profile	4.3.8		
2A	3,8 GHz < f ≤ 4,2 GHz	OFR	4.3.2	RSE	4.4.3
		Mean e.i.r.p. spectral density	4.3.3	RBS	4.4.4
		Peak e.i.r.p. spectral density	4.3.4	RBR	4.4.5
		TX unwanted emissions	4.3.5		
		Duty Cycle	4.3.6		
		TX behaviour in the complete environmental profile	4.3.8		
2B	6,0 GHz < f ≤ 8,5 GHz	OFR	4.3.2	RSE	4.4.3
		Mean e.i.r.p. spectral density	4.3.3	RBS	4.4.4
		Peak e.i.r.p. spectral density	4.3.4	RBR	4.4.5
		TX unwanted emissions	4.3.5		
		TX behaviour in the complete environmental profile	4.3.8		

4.3 Transmitter requirements

4.3.1 General

The present document covers the requirements for one transmitter (single EUT) and not combinations of EUTs at the car or a combination in a system (keyless entry system based on combinations of Type 1 and Type 2 devices).

Assessment of Low Duty Cycle and Trigger-before-transmit are related to the transmissions per EUT.

4.3.2 Operating Frequency Range (OFR)

4.3.2.1 Applicability

The Operating Frequency Range requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.3.2.2 Description and general requirements

Operating frequency range is defined in clause 5.2.1 of ETSI EN 303 883-1 [1].

For the OFR conformance assessment the number of 10 dB for the parameter X shall be considered (parameter X as specified in ETSI EN 303 883-1 [1], clause 5.2.1).

4.3.2.3 Limits

The OFR (all frequencies between f_L and f_H) shall be within one of the permitted frequency ranges (see Table 3).

The OFR shall be at least 50 MHz.

NOTE: The minimum OFR requirement is defined in the EC Decision 2024/1467 [i.7], Article 2 (a).

Table 3: Permitted frequency ranges for vehicular access systems according to ECC/DEC/(06)04 [i.4] and Decision (EU) 2024/1467 [i.7]

	Frequency Range	Application
Transmit and Receive	3,8 GHz < f ≤ 4,2 GHz	Vehicular access
Transmit and Receive	6,0 GHz < f ≤ 8,5 GHz	Vehicular access

4.3.2.4 Conformance

The conformance test for OFR shall be as defined in clause 5.3.2.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.3.3 Mean e.i.r.p. spectral density

4.3.3.1 Applicability

The Mean e.i.r.p. spectral density requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.3.3.2 Description

The Mean e.i.r.p. spectral density is described in clause 5.3.2 of ETSI EN 303 883-1 [1].

4.3.3.3 Limits

Within the OFR the Mean e.i.r.p. spectral density shall not exceed the limits in Table 4.

Table 4: Mean e.i.r.p. spectral density limits according to ECC/DEC/(06)04 [i.4] and Decision (EU) 2024/1467 [i.7]

Frequency range	Maximum mean e.i.r.p. spectral density
3,8 GHz < f ≤ 4,2 GHz	-41,3 dBm/MHz
6,0 GHz < f ≤ 8,5 GHz	-41,3 dBm/MHz

4.3.3.4 Conformance

The conformance test for Mean e.i.r.p. spectral density shall be as defined in clause 5.3.3.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.3.4 Peak e.i.r.p. spectral density

4.3.4.1 Applicability

The Peak e.i.r.p. spectral density requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.3.4.2 Description

The Peak e.i.r.p. spectral density is defined in clause 5.3.4 of ETSI EN 303 883-1 [1].

4.3.4.3 Limits

The Peak e.i.r.p. spectral density shall not exceed the limits in Table 5.

Table 5: Peak e.i.r.p. spectral density limits according to ECC/DEC/(06)04 [i.4] and Decision (EU) 2024/1467 [i.7]

Frequency range	Maximum peak e.i.r.p. (defined in 50 MHz)
3,8 GHz < f ≤ 4,2 GHz	0 dBm
6,0 GHz < f ≤ 8,5 GHz	0 dBm

4.3.4.4 Conformance

The conformance test for Peak e.i.r.p. spectral density shall be as defined in clause 5.3.4.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.3.5 TX unwanted emissions

4.3.5.1 Applicability

The TX unwanted emissions requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.3.5.2 Description

For the description of the TX unwanted emissions, see ETSI EN 303 883-1 [1], clause 5.5.1.

As requested in ETSI EN 303 883-1 [1], clause 5.5.1 the limit for the parameter X_{TXUE} for all EUTs (Equipment Type 1 and Type 2) is specified to:

- X_{TXUE}: 50 %

4.3.5.3 Limits

The TX unwanted emissions shall be assessed based on ETSI EN 303 883-1 [1], clause 5.5.2.

The spurious emission limits are defined in Table 6.

Table 6: Spurious emissions limits according to ERC Recommendation 74-01 [i.15]

Frequency range	Limit values for TXUE
87,5 MHz ≤ f ≤ 118 MHz	-54 dBm/100 kHz
174 MHz ≤ f ≤ 230 MHz	-54 dBm/100 kHz
470 MHz ≤ f ≤ 694 MHz	-54 dBm/100 kHz
Otherwise in band 30 MHz ≤ f ≤ 1 000 MHz	-36 dBm/100 kHz
1 000 MHz < f ≤ F_{upper} (see Table 7)	-30 dBm/1 MHz
NOTE: Not applicable for RP emissions within the OFR.	

The lower and upper frequency for the spurious emissions test based on the EUT OFR shall comply with Table 7.

Table 7: Lower and upper frequency for the spurious emissions test based on the EUT OFR according to ERC Recommendation 74-01 [i.15]

Fundamental frequency range defined by f_L and f_H (note 2)	Frequency range for measurements	
	Lower frequency (F_{LOWER})	Upper frequency (F_{UPPER})
3,8 GHz < f ≤ 4,2 GHz	30 MHz	5th harmonic (note 1)
6,0 GHz < f ≤ 8,5 GHz	30 MHz	26 GHz
NOTE 1: F_{UPPER} is the stated harmonic of f_H (the upper edge of the OFR, which is measured in clause 4.2.2). NOTE 2: F_{LOWER} has to be selected based on f_L and F_{UPPER} based on f_H (f_L and f_H can be measured according to clause 4.2.2); for receive only devices f_H and f_L of the related EUT/companion device shall be used.		

Based in TXUE specification of 50 % (see clause 5.3.5) there is no OOB-domain for EUT in UWB-mode. Therefore, an OOB domain is not applicable.

4.3.5.4 Conformance

The conformance test for TX unwanted emissions shall be as defined in clause 5.3.5.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.3.6 Duty Cycle

4.3.6.1 Applicability

The Duty Cycle requirement applies to the Type 1A, Type 1B category if operated in the frequency range from 3,8 GHz to 4,2 GHz and Type 2A category as described in Table 2 in clause 4.2.3.

4.3.6.2 Description

For the description of the Duty Cycle (DC), see ETSI EN 303 883-1 [1], clause 5.11.1.

4.3.6.3 Limits

The measured Duty Cycle shall comply with the limits in Table 8.

Table 8: Duty Cycle limits according to ECC/DEC/(06)04 [i.4] and Decision (EU) 2024/1467 [i.7]

Limits	Remarks
$T_{on\ max}$ = 5 ms $T_{off\ mean}$ ≥ 38 ms (averaged over 1 s) Σ T_{off} > 950 ms per s	Short-term duty-cycle requirements for T_{obs} = 1 s: • Σ T_{off} > 950 ms sets the duty-cycle limit to 5 % (see notes 2 and 3) • $T_{off\ mean}$ ≥ 38 ms implicitly limits the number of On-Periods and thus the achievable duty-cycle for short T_{on} times
Σ T_{on} < 18 s per hour	Long-term duty-cycle requirement for T_{obs} = 3 600 s • Σ T_{on} < 18 s sets the duty-cycle limit per hour to 0,5 %
NOTE 1: The limits are based on the "Low Duty Cycle" requirements in ECC/DEC/(06)04 [i.4], annex 2. NOTE 2: 5 % Duty-Cycle can only be achieved with T_{on} times larger than 2 ms (and maximum 5 ms). NOTE 3: The limits allow a Short-Term Duty-Cycle of up to 5 %. Devices with T_{on} < 2 ms cannot exploit this Short-Term Duty-Cycle of 5 %, as $T_{off\ mean}$ is the limiting factor. The resulting Short-Term Duty-Cycle for those devices is then considerably smaller than 5 %.	

4.3.6.4 Conformance

The conformance test for Duty Cycle shall be as defined in clause 5.3.6.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.3.7 Trigger-before-transmit

4.3.7.1 Applicability

The Trigger-before-transmit requirement applies to the Type 1A and 1B categories as described in Table 2 in clause 4.2.3.

4.3.7.2 Description

4.3.7.2.1 General

"Trigger-before-transmit" follows the objective that the EUT initiates UWB transmissions only if necessary: The EUT shall only transmit, if a "trigger" event indicates that a (companion) UWB device is in range; in particular the trigger indicates the physical proximity of a Type 2 equipment (e.g. key fob as stated in ECC Report 278 [i.6], chapters 2.1.2 and 2.2.2).

NOTE: Further information on "trigger-before-transmit" is given in ECC/DEC/(06)04 [i.4] (annex 1.2.2) and in Decision (EU) 2024/1467 for UWB [i.7] (annex 3).

4.3.7.2.2 Trigger event from use case perspective

From use case perspective a "trigger event" may have various embodiments, like a successful handshake between device and vehicle using non-UWB wireless technologies (e.g. BLE or NFC), or user detection by non-UWB techniques.

In general, the actual "trigger event" involves vehicle system entities that are out of scope for the EUT (like authentication procedures by a Body Control Module, evaluation of vehicle sensors or simply an authenticated user pulling the door handle).

However, the system "trigger event" can be mapped on a trigger scenario at EUT level, to make it measurable in the context of the present document.

4.3.7.2.3 Trigger scenarios on EUT level

Two basic scenarios are conceivable on EUT level for Type 1 equipment:

1) EUT is responder device (EUT category 1A):
   Upon a system trigger event the EUT is set to listening mode for UWB packets.
   UWB transmission is triggered when EUT receives an UWB packet from a (companion) UWB device.
   → EUT-trigger is a successful UWB packet reception from a companion device.
   → Details for Trigger Scenario 1 are described in clause 4.3.7.2.4.

2) EUT is initiator device (EUT category 1B):
   Upon a system trigger event the EUT is set to UWB transmission mode.
   UWB transmission is triggered when EUT receives a transmit command via its control interface.
   → EUT-trigger is a control command to the EUT, sent via its dedicated control interface.
   → Details for Trigger Scenario 2 are described in clause 4.3.7.2.5.

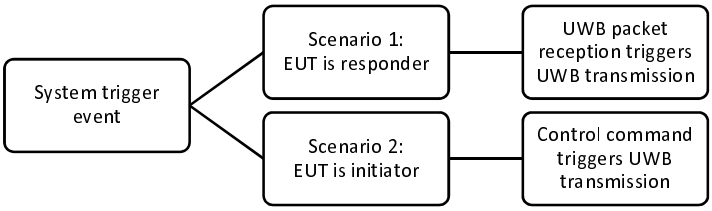

Figure 1: Trigger scenarios

4.3.7.2.4 Trigger Scenario 1: EUT Category 1A

Figure 2 shows Trigger Scenario 1.

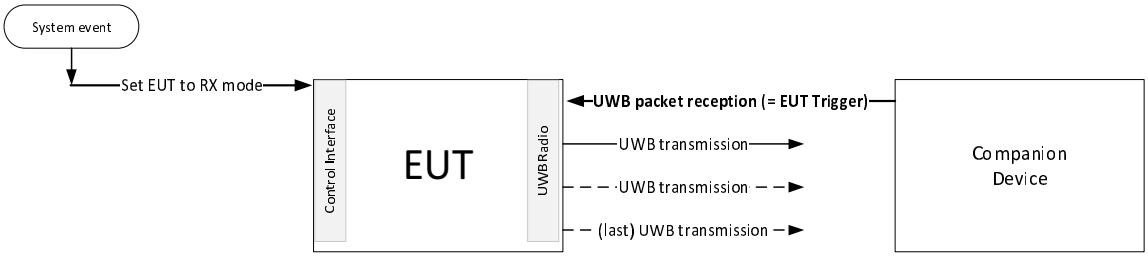

Figure 2: EUT is responder device: UWB transmission is triggered by reception of an UWB signal from a companion device

If the EUT receives an UWB packet from a companion device, it will send one or more UWB transmissions (response message and associated packets).

Receiving further packets from the companion device may trigger further UWB transmissions from the EUT (updated EUT trigger, Re-trigger).

4.3.7.2.5 Trigger Scenario 2: EUT Category 1B

Figure 3 shows Trigger Scenario 2.

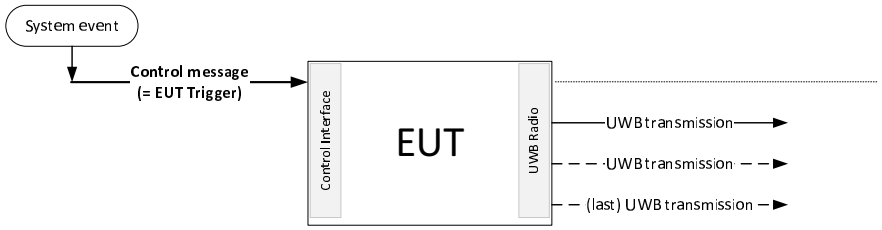

Figure 3: EUT is initiator device: UWB transmission is triggered by a control message upon a system event

The EUT is triggered by a control message and sends one or more UWB transmissions (poll message and associated packets).

Like in Trigger Scenario 1, receiving packets (responses) from the companion device may trigger further UWB transmissions from the EUT (updated EUT trigger, Re-trigger).

4.3.7.2.6 General requirements

"Trigger-before-transmit" shall be characterized by:

- Trigger-Before-Transmit timeout $TBT_{timeout}$:
  - this is the time after the (latest) EUT-trigger, until the EUT ceases all UWB transmissions.
- Trigger-Before-Transmit On-Time $TBT_{On\text{-}Time}$:
  - this is the cumulated T_{on} time within any 10 s window after any trigger event.

For both trigger scenarios, each reception of an UWB packet is considered as a new trigger, and shall reset the "trigger-before-transmit" timeout.

For Trigger Scenario 2, further control messages without having received a UWB response from a companion device shall not reset the "trigger-before-transmit" timeout, and TBT limits have to be fulfilled with respect to the first control message.

A control message shall be accepted as updated EUT trigger earliest 10 s after the last EUT transmission.

4.3.7.3 Limits

The limits given in Table 9 shall not be exceeded.

Table 9: Trigger-before-transmit Limits

Trigger-Before-Transmit timeout $TBT_{timeout}$ Cease time for UWB transmissions after EUT trigger (reception of UWB packets resets the timeout)	max 10 s
Trigger-Before-Transmit On-Time $TBT_{On\text{-}Time}$ Cumulated Ton time T_{on_cum} within any 10 s window after any trigger event	max 50 ms

Figure 4 is a graphical interpretation of the Trigger-before-transmit limits.

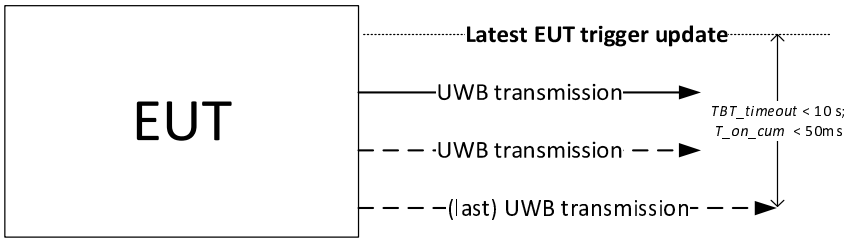

Figure 4: Trigger-before-transmit limits

For the justification of Trigger-before-transmit limits see annex C.

4.3.7.4 Conformance

The conformance test for Trigger-before-transmit shall be as defined in clause 5.3.7.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.3.8 TX behaviour under the complete environmental profile

4.3.8.1 Applicability

The TX behaviour under the complete environmental profile requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.3.8.2 Description

The TX behaviour under the complete environmental profile verifies the conformance of the Mean e.i.r.p. spectral density over the environmental profile as specified in clause 5.1.3.

For more information on the TX behaviour under the complete environmental profile, see ETSI TS 103 941 [3], clause 4.3.1

4.3.8.3 Limits

The TX behaviour is obtained by measuring the Mean e.i.r.p. spectral density across the complete environmental profile (as specified in clause 5.1.3 and assessing the variation with respect to an adjusted Regulated Limit (RL)).

The procedure to adjust the regulated limit is descripted in ETSI TS 103 941 [3], clause 6.4.

4.3.8.4 Conformance

The conformance test for TX behaviour under the complete environment profile shall be as defined in clause 5.3.8.

The conformance test shall be done under the complete environmental profile as defined in clause 5.1.3;

4.4 Receiver requirements

4.4.1 General

Based on this justification the following Receiver requirements apply for the EUT covered by the present document:

- Receiver spurious emissions, see clause 4.4.3.
- Receiver Baseline Sensitivity (RBS), see clause 4.4.4.

- Receiver Baseline Resilience (RBR), see clause 4.4.5.

NOTE: The receiver requirements for EUT covered by the scope of the present document are justified in ETSI EN 303 883-2 [2], annex C.

4.4.2 Wanted Technical Performance Criteria

4.4.2.1 Wanted Technical Performance Criterion 1

The wanted technical performance criterion 1 is used for the RBS and RBR tests.

The EUT shall fulfil a Message Success Rate better than 90 %.

For the RBR test the EUT shall meet this requirement also during interferer present, as shown in Figure 5.

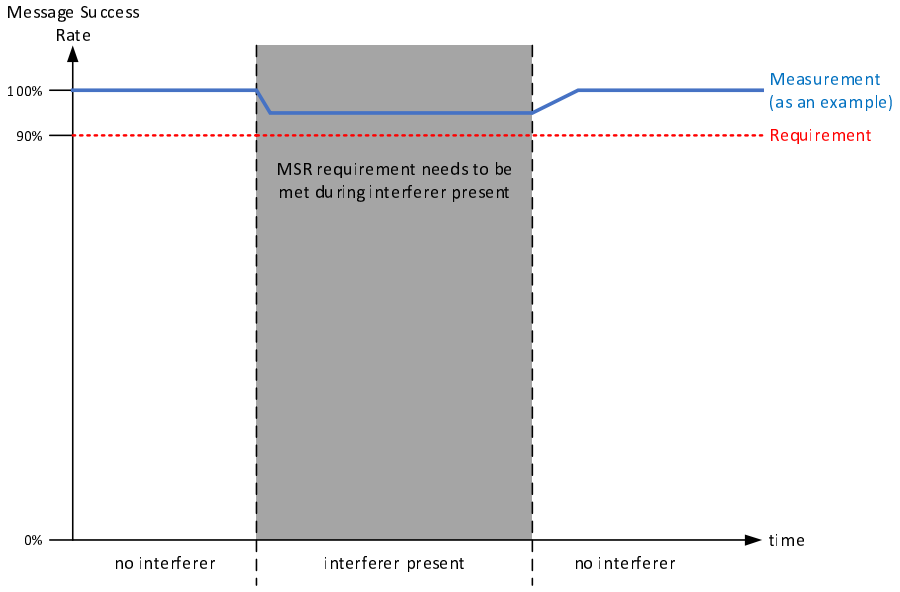

Figure 5: Wanted technical performance criterion 1 for RBR test

The EUT shall support the determination of the MSR for all relevant test setups in the present document.

The MSR shall be determined with at least 20 messages (e.g. 18 successful message detections out of 20).

NOTE 1: The equipment covered by the present document uses a packet-based exchange for distance bounding and/or location tracking and/or data transfer. This exchange is referred to as "message". The performance requirement is based on the successful detection of messages by the EUT. An adequate Message Success Rate (MSR), as specified in the present document, is, therefore, an appropriate wanted technical performance criterion.

NOTE 2: For the general case of proprietary protocols, supporting a MSR measurement will require that the manufacturer provides an appropriate companion device or signal generator configuration to generate a "wanted signal", as well as tools to read out successful message detection from the EUT and calculate MSR.

4.4.2.2 Wanted Technical Performance Criterion 2

The wanted technical performance criterion 2 is used for the RBR tests only.

The wanted technical performance criterion 2 takes into account the non-protected nature of UWB operations.

During the presence of an interferer, the EUT may have a temporary loss of function or degradation of performance.

However, when the interferer is removed, the EUT shall recover its normal performance - which is a message success rate better than 90 % (see clause 4.3.2.1) - without operator intervention.

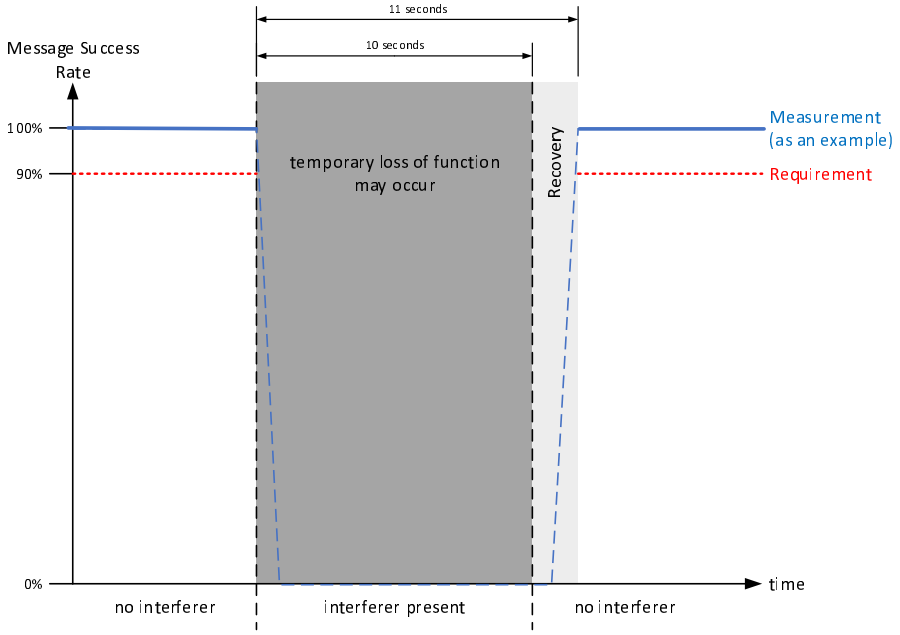

Figure 6: Wanted technical performance criterion 2 for RBR test

The requirements for the wanted technical performance criterion 2 are listed below and are depicted in Figure 6:

- Interference shall be present for 10 seconds.
- Recovery of performance shall be completed 1 second after interference has been removed.
- After 11 seconds the MSR measurement is started and the EUT shall fulfil message success rate better than 90 %.

4.4.3 Receiver spurious emissions

4.4.3.1 Applicability

The Receiver spurious emissions requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.4.3.2 Description

For the description of the Receiver spurious emissions, see ETSI EN 303 883-2 [2], clause 5.2.1.

4.4.3.3 Limits

The Receiver spurious emissions shall comply with limits in Table 10.

Table 10: Receiver spurious emission limits according to ERC Recommendation 74-01 [i.15]

Frequency range	Limit values
$F_{LOWER} \leq f \leq 1\,000$ MHz	-57 dBm
1 000 MHz < f ≤ F_{UPPER} (see Table 11)	-47 dBm
NOTE: F_{UPPER} and F_{LOWER} are linked with the OFR of the EUT, see Table 11.	

The frequency range for the RX spurious emission test shall be as defined in Table 11.

Table 11: Frequency range for the RX spurious emissions test, linked with EUT OFR according to ERC Recommendation 74-01 [i.15]

Fundamental frequency range defined by f_L and f_H	Frequency range for measurements	
	Lower frequency (F_{LOWER})	Upper frequency (F_{UPPER})
3,8 GHz < f ≤ 4,2 GHz	30 MHz	5th harmonic (note 1)
6,0 GHz < f ≤ 8,5 GHz	30 MHz	26 GHz
NOTE 1: F_{UPPER} is the stated harmonic of f_H (the upper edge of the OFR, which is measured in clause 4.2.2).		
NOTE 2: F_{LOWER} has to be selected based on f_L and F_{UPPER} based on f_H (f_L and f_H can be measured according to ETSI clause 4.2.2); for receive only devices f_H and f_L of the related EUT/companion device shall be used.		

4.4.3.4 Conformance

The conformance test for Receiver spurious emission shall be as defined in clause 5.4.1.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.4.4 Receiver Baseline Sensitivity (RBS)

4.4.4.1 Applicability

The Receiver Baseline Sensitivity (RBS) requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.4.4.2 Description

For the description of the Receiver Baseline Sensitivity (RBS), see ETSI EN 303 883-2 [2], clause 5.4.

4.4.4.3 Limits

The Receiver Baseline Sensitivity (RBS) is defined as the "received power at the EUT ($P_{@EUT}$)" (according to ETSI EN 303 883-2 [2], clause 5.4.3.3) and shall be at least 70 dB below the maximum Mean e.i.r.p. spectral density level of -41,3 dBm/MHz:

- Receiver Baseline Sensitivity: $P_{@EUT} \leq$ -111,3 dBm/MHz

NOTE 1: Received power at the EUT ($P_{@EUT}$) includes the RX antenna gain (of the integral or associated or dedicated EUT antenna).

NOTE 2: Reasoning of Baseline Sensitivity requirement:
The Keyless Entry use case (see ETSI TR 103 416 [i.3]) requires reliable operation even under heavy human body attenuation or blockage scenarios. This can be achieved with a good link budget and/or installation of additional UWB nodes at the vehicle. Spectrum efficiency is deteriorated, if link budget due to poor RX sensitivity is traded off against node count, as this will add unnecessary air traffic. This justifies the requirement for a "Baseline Sensitivity".

NOTE 3: Baseline Sensitivity is defined with the same unit as Mean e.i.r.p. spectral density, and therefore the measurement methods for Mean e.i.r.p. spectral density can be reused for quantifying the received power at the EUT.

The wanted technical performance criteria for all Equipment Type 1 and Type 2 for the RBS tests shall be criterion 1, as defined in clause 4.4.2.1.

4.4.4.4 Conformance

The conformance test for Receiver Baseline Sensitivity (RBS) shall be as defined in clause 5.4.2.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

4.4.5 Receiver Baseline Resilience (RBR)

4.4.5.1 Applicability

The Receiver Baseline Resilience (RBR) requirement applies to all EUT categories as described in Table 2 in clause 4.2.3.

4.4.5.2 Description

For the description of the Receiver Baseline Resilience (RBR), see ETSI EN 303 883-2 [2], clause 5.5.

4.4.5.3 Limits

The present document considers two interference scenarios:

- Interference Scenario 1: Weak interference: Wanted Technical Performance Criterion 1 (clause 4.4.2.1) shall be fulfilled.
- Interference scenario 2: Strong interference: Wanted Technical Performance Criterion 2 (clause 4.4.2.2) shall be fulfilled.

Both interference scenarios shall be tested and the EUT shall comply with the limits given in Table 12 and Table 13.

Limits for the interferer within OFR shall be as shown in Table 12.

Table 12: RBR limits within OFR

<table>
<tr><th></th><th>Interference Scenario</th><th>Interference power level at EUT</th><th>Wanted technical performance criterion</th><th>Test frequencies</th><th>Modulation of test signals</th></tr>
<tr><td rowspan="2">Type 1 equipment</td><td>Scenario 1</td><td>-85 dBm</td><td>Criterion 1</td><td rowspan="4">• f_L (lower edge of OFR)
• f_c (centre frequency of wanted signal)
• f_H (upper edge of OFR)</td><td rowspan="4">CW</td></tr>
<tr><td>Scenario 2</td><td>-50 dBm</td><td>Criterion 2</td></tr>
<tr><td rowspan="2">Type 2 equipment</td><td>Scenario 1</td><td>-75 dBm</td><td>Criterion 1</td></tr>
<tr><td>Scenario 2</td><td>-50 dBm</td><td>Criterion 2</td></tr>
</table>

Limits for the interferer outside OFR shall be as shown in Table 13.

Table 13: RBR limits outside OFR

<table>
<tr><th></th><th>Interference Scenario</th><th>Interference power level at EUT</th><th>Wanted technical performance criterion</th><th>Test frequencies</th><th>Modulation of test signals</th></tr>
<tr><td rowspan="2">Type 1 equipment</td><td>Scenario 1</td><td>-85 dBm</td><td>Criterion 1</td><td rowspan="4">• f_c - 2 × OFR
• f_c - 1 × OFR
• f_c + 1 × OFR
• f_c + 2 × OFR</td><td rowspan="4">CW</td></tr>
<tr><td>Scenario 2</td><td>-50 dBm</td><td>Criterion 2</td></tr>
<tr><td rowspan="2">Type 2 equipment</td><td>Scenario 1</td><td>-75 dBm</td><td>Criterion 1</td></tr>
<tr><td>Scenario 2</td><td>-50 dBm</td><td>Criterion 2</td></tr>
</table>

NOTE: The derivation of the above limits in Tables 12 and 13 is described in annex D.

4.4.5.4 Conformance

The conformance test for Receiver Baseline Resilience (RBR) shall be as defined in clause 5.4.3.

The conformance test shall be done under normal conditions as defined in clause 5.1.2.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

5.1.1 General

Tests defined in the present document shall be carried out at representative points within the boundary limits of the operational environmental profile defined by its intended use, which, as a minimum, shall be that specified in the test conditions contained in the present document.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions as specified in the present document to give confidence of compliance for the affected technical requirements.

5.1.2 Normal test conditions

Normal test conditions shall be as defined in ETSI TS 103 941 [3], clause 4.5.3.1.

The temperature for testing under normal temperature conditions shall be within +15 °C to +35 °C as specified in ETSI TS 103 941 [3], clause 4.5.3.1.1.

5.1.3 Complete environmental profile test conditions

The complete environmental profile test conditions cover both the normal (see clause 5.1.2) and extreme test conditions.

The temperature range specified for the equipment type shall cover the temperature range of Table 14.

The complete environmental profile conditions shall be as defined in clause ETSI TS 103 941 [3], clause 4.5.3.2 with the temperature range of Table 14:

Table 14: Temperature range for the complete environmental profile test

Type of equipment	Minimum	Maximum
Type 1	-40 °C	+85 °C
Type 2	0 °C	+50 °C

The nominal supply voltage shall be as specified for the intended use for the equipment (e.g. in the user manual or technical specification file).

5.2 General conditions for testing and conformance test suites

5.2.1 General conditions for testing

ETSI EN 303 883-1 [1], annex A provides information on general conditions for testing, e.g. test environment and test conditions, measurement uncertainty and interpretation of the measurement results. An overview is provided in ETSI EN 303 883-1 [1], clause A.1.

General conditions for testing for the TX measurements shall be as defined in ETSI EN 303 883-1 [1], clauses A.3, A.5 and A.8.

General conditions for testing for the RX measurements shall be as defined in ETSI EN 303 883-2 [2], clause 5.1.

5.2.2 Conformance test suites

The choice of equipment shall follow ETSI EN 303 883-1 [1], clause A.6.

Radiated tests shall be carried out in an Anechoic Chamber according to ETSI EN 303 883-1 [1], clause B.2.2.2.

5.2.3 Test scenarios

Setup for Equipment Type 1 (vehicle transceivers):

- The EUT shall be measured as a stand-alone component.

Setup for Equipment Type 2 (vehicle ID devices):

- for the measurement the ID device shall include any typical accessory, e.g. (removable) metal key blade;
- the ID device shall be measured as a stand-alone component (e.g. no emulation of human body or hand).

5.3 Conformance methods of measurement for transmitter

5.3.1 General

See clause 5.1 of ETSI EN 303 883-1 [1] for general guidance on TX measurements and emission concept.

5.3.2 Operating Frequency Range (OFR)

The OFR conformance tests shall be performed on a test site according to ETSI EN 303 883-1 [1], clause B.2.2.2 (anechoic chamber) and the test setup shall be the spherical scan test method as described in ETSI EN 303 883-1 [1], clause B.4.1.

For the OFR conformance assessment, at the direction of the highest Mean e.i.r.p. spectral density (see clause 5.3.3), the conformance test procedure as specified in ETSI EN 303 883-1 [1], clause 5.2.2 shall be used.

The OFR conformance assessment shall be determined with the number for the parameter X as specified in clause 4.3.2.2.

The Mean e.i.r.p. spectral density measurement (see clause 5.3.3) shall be the reference for the OFR assessment.

The measurement distance d is defined as the distance from the EUT to the measurement antenna. For the measurement distance d = 3 m shall be used.

If based on the low emission levels of the EUT the noise level of the overall measurement system (ETSI EN 303 883-1 [1], clause B.2.5) has less than 16 dB margin to the highest radiated Mean e.i.r.p. power spectral density (see clause 5.3.3), a smaller measurement distance d shall be used, and the measurement distance assessment as descripted as range length in ETSI EN 303 883-1 [1], clause B.2.3.5 shall be done.

5.3.3 Mean e.i.r.p. spectral density

The Mean e.i.r.p spectral density conformance tests shall be performed on a test site according to ETSI EN 303 883-1 [1], clause B.2.2.2 (anechoic chamber) and the test setup shall be the spherical scan test method as described in ETSI EN 303 883-1 [1], clause B.4.1.

For the Mean e.i.r.p spectral density conformance assessment, the conformance test method as specified in ETSI EN 303 883-1 [1], clause 5.3.2.3 ("Mean e.i.r.p. spectral density, averaged over 1 ms") shall be used.

For a full spherical assessment, the EUT need to be turned by 180 degrees around the horizontal plane (see ETSI EN 303 883-1 [1], clause B.4).

For angular steps delta Θ and delta Φ a value of 15 degrees shall be used.

The measurement distance d is defined as the distance from the EUT to the measurement antenna. For the measurement distance d = 3 m shall be used.

If the noise level of the overall measurement system (ETSI EN 303 883-1 [1], clause B.2.5) has less than 10 dB margin to the maximum Mean e.i.r.p. spectral density limits (see clause 4.3.3.3), a smaller measurement distance d shall be used, and the measurement distance assessment as descripted as range length in ETSI EN 303 883-1 [1], clause B.2.3.5 shall be done.

5.3.4 Peak e.i.r.p. spectral density

The Peak e.i.r.p spectral density conformance tests shall be performed on a test site according to ETSI EN 303 883-1 [1], clause B.2.2.2 (anechoic chamber) and the test setup shall be the spherical scan test method as described in ETSI EN 303 883-1 [1], clause B.4.1.

Conformance shall be tested according to ETSI EN 303 883-1 [1], clause 5.3.4.1.3 ("General method") and RBW of 50 MHz shall be used.

For a full spherical assessment, the EUT needs to be turned by 180 degrees around the horizontal plane (see ETSI EN 303 883-1 [1], clause B.4).

For angular steps delta Θ and delta Φ a value of 15 degrees shall be used.

The measurement distance d is defined as the distance from the EUT to the measurement antenna. For the measurement distance d = 3 m shall be used.

5.3.5 TX unwanted emissions

The TX unwanted emission conformance tests shall be performed on a test site according to ETSI EN 303 883-1 [1], clause B.2.2.2 (anechoic chamber) and the test setup shall be the spherical scan test method as described in ETSI EN 303 883-1 [1], clause B.4.1.

For a full spherical assessment, the EUT needs to be turned by 180 degrees around the horizontal plane (see ETSI EN 303 883-1 [1], clause B.4).

For angular steps delta Θ and delta Φ a value of 15 degrees shall be used.

The measurement distance d is defined as the distance from the EUT to the measurement antenna. For the measurement distance d = 3 m shall be used.

The conformance test procedure as specified in ETSI EN 303 883-1 [1], clause 5.5.3.1 shall be used.

For the RMS assessment the test procedure step 2a as specified in ETSI EN 303 883-1 [1], clause 5.5.3.1.3 shall be used.

The average time for step 2a (Burst duration / T_{on} time) can be assessed with the conformance test procedure in clause 5.3.6.1 of the present document.

5.3.6 Duty Cycle

5.3.6.1 Short-Term Duty Cycle

For the Short-Term Duty Cycle conformance test the set-up as specified in clause 5.3.3 and the conformance test procedure as specified in ETSI EN 303 883-1 [1], clause 5.11.2.1 ("Duty cycle, spectrum analyser method") shall be used.

The measurement receiver with the related measurement antenna shall be placed in the direction of highest Mean e.i.r.p spectral density emission (see clause 5.3.3).

NOTE 1: Duty Cycle conformance assessment is only necessary in the direction of the highest Mean e.i.r.p spectral density emission, because with this test the nature of the TX-signal will be tested and not the complete emission of the EUT (see clause 5.3.3).

For the measurement distance d, the same distance than for the Mean e.i.r.p spectral density emission conformance test shall be used (see clause 5.3.3).

If based on the low emission levels of the EUT the noise level of the overall measurement system (ETSI EN 303 883-1 [1], clause B.2.5) has less than 16 dB margin to the measured P_{max} (see below), a smaller measurement distance d shall be used, and the measurement distance assessment as descripted as range length in ETSI EN 303 883-1 [1], clause B.2.3.5 shall be done.

Following parameters shall be used for Short-Term-Duty-Cycle tests:

- T_{obs} = 1 s
- T_{dis} = 10 µs

NOTE 2: This value for disregard time T_{dis} is large enough to span pulse-based symbols and include them in the On-time, but small enough to differentiate packets and account the time between as Off-time.

- RBW = 1 MHz
- VBW = 3 MHz
- Detector mode: Peak
- $P_{thresh} = P_{max}$ - 10 dB

NOTE 3: P_{thresh} and P_{max} are related to the duty-cycle measurement settings (RBW = 1 MHz, Peak Detector). P_{max} denotes the maximum level of the signal measured.

5.3.6.2 Long-Term Duty Cycle

For the Long-Term Duty Cycle conformance test the set-up as specified in clause 5.3.3 and the conformance test procedure as specified in ETSI EN 303 883-1 [1], clause 5.11.2.1 ("Duty cycle, spectrum analyser method") shall be used.

The measurement receiver with the related measurement antenna shall be placed in the direction of highest Mean e.i.r.p spectral density emission (see clause 5.3.3).

NOTE 1: Duty Cycle conformance assessment is only necessary in the direction of the highest Mean e.i.r.p spectral density emission, because with this test the nature of the TX-signal will be tested and not the complete emission of the EUT (see clause 5.3.3).

For the measurement distance d, the same distance than for the Mean e.i.r.p spectral density emission conformance test shall be used (see clause 5.3.3).

If based on the low emission levels of the EUT the noise level of the overall measurement system (ETSI EN 303 883-1 [1], clause B.2.5) has less than 16 dB margin to the measured P_{max} (see below), a smaller measurement distance d shall be used, and the measurement distance assessment as descripted as range length in ETSI EN 303 883-1 [1], clause B.2.3.5 shall be done.

Following parameters shall be used for Long-Term-Duty-Cycle assessment:

- T_{obs} = 60 s
- T_{dis} = 10 µs

NOTE 2: This disregard time is large enough to span pulse-based symbols and include them in the On-time, but small enough to differentiate packets and account the time between as Off-time.

- RBW = 1 MHz
- VBW = 3 MHz
- Detector mode: Peak
- $P_{thresh} = P_{max}$ - 10 dB

The measured ΣT_{on} in 60 s shall be used to extrapolate the cumulated on-time for 1 hour:

$$\Sigma T_{on} (1 \text{ hour}) = \Sigma T_{on} (60 \text{ s}) \times 60$$

NOTE 3: The Long-Term-Duty-Cycle requirement is implicitly fulfilled, if the EUT is compliant to "Trigger-before-transmit".

NOTE 4: The extrapolation from 60 s to 1 hour does not put a harder Long-Term-Duty-Cycle requirement to the EUT, if the T_{on} time of one transmission is less than 190 µs (because the 38 ms $T_{off\ mean}$ requirement is the limiting parameter). This is typically the case for Keyless Entry protocols.

5.3.7 Trigger-before-transmit

5.3.7.1 General

For the Trigger-before-transmit conformance test the set-up as specified in clause 5.3.3 shall be used.

The companion device shall be placed at 1 m distance in the direction of the highest Mean e.i.r.p spectral density emission (see clause 5.3.3).

Conformance for "Trigger-before-transmit" shall be tested using a procedure as below.

The measurement can be radiated or conducted, using a spectrum analyser in Zero-Span with settings as for clause 4.3.6 ("Duty Cycle") or an oscilloscope - those methods provide equivalent results for the time domain.

Depending on the trigger scenario one of following test setups and procedures shall be used:

- Trigger Scenario 1: see clause 5.3.7.2.
- Trigger Scenario 2: see clause 5.3.7.3.

5.3.7.2 Setup for Trigger Scenario 1

Figure 7 shows the setup for Trigger Scenario 1, where EUT is responder, and trigger is a received UWB packet.

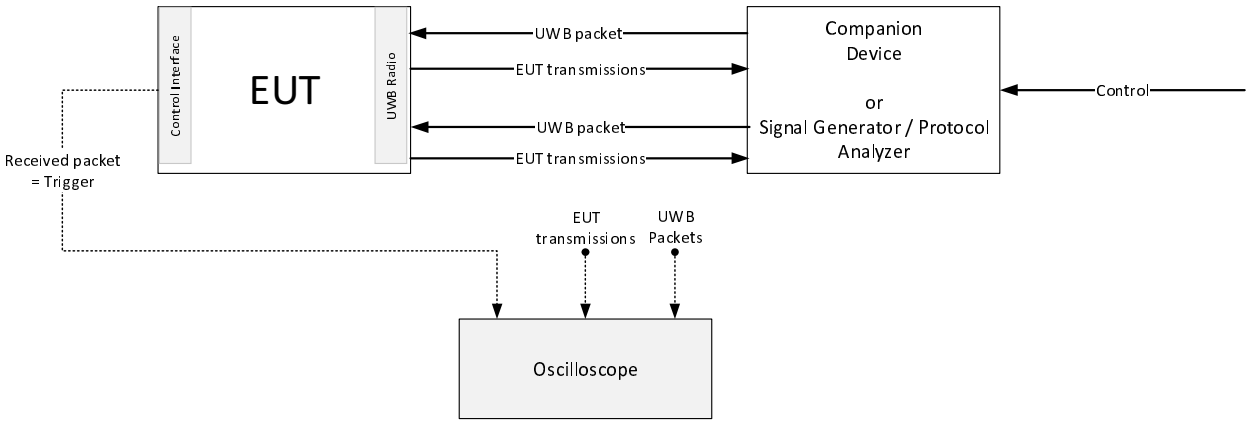

Figure 7: Setup for Trigger Scenario 1

The manufacturer shall provide a companion device including control equipment or provide necessary information how to configure signal generator and protocol analyser. (In the following text, "companion device" will be used for either embodiment.)

Procedure:

1) Companion device sends a single packet:

   a) Verify at EUT control interface that packet has been received.

   b) Measure TBT timeout and cumulated ON-time at EUT UWB radio interface, relative to the sent packet from the companion device.

   c) The measured values shall comply with the Trigger-before-transmit limits.

2) Companion device sends repeating packets, repetition time < 10 s:

   a) Measure cumulated ON-time T_{cum_on} within any 10 s.

   b) Vary (reduce) repetition time, to determine the worst case cumulated ON-time T_{cum_on}.

   c) The maximum value for T_{cum_on} shall be recorded and shall comply with the Trigger-before-transmit limit.

3) Deactivate repeating packet transmissions:

   a) Verify that EUT stops transmitting.

   b) Measure TBT timeout, relative to the last received UWB packet.

   c) The larger value of 1b or 2b shall be recorded as result for $TBT_{timeout}$ and shall comply with the limit.

The test procedure shall include at least 10 repetitions of the trigger signal, before deactivating the companion device. The repetitions shall confirm identical behaviour of the EUT or reveal worst-case behaviour.

The observation time after the (latest) trigger shall be at least 1 min to confirm that the EUT has ceased UWB transmissions.

The test shall cover all operational modes of the EUT.

5.3.7.3 Setup for Trigger Scenario 2

Figure 8 shows the setup for Trigger Scenario 2, where EUT is initiator, and trigger is a control message.

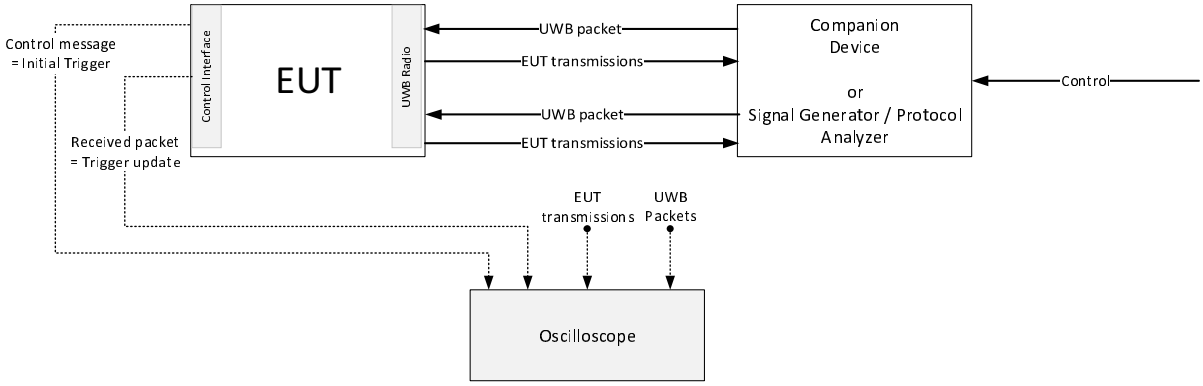

Figure 8: Setup for Trigger Scenario 2

The manufacturer shall provide a companion device including control equipment or provide the necessary information how to configure signal generator and protocol analyser. (In the following text, "companion device" will be used for either embodiment.)

Procedure:

1) Control equipment sends a control message to EUT:

   a) EUT sends one or more transmissions.

   b) Measure TBT timeout and cumulated ON-time at EUT UWB radio interface, relative to the start of the first EUT transmission.

   c) The measured values shall comply with the Trigger-before-transmit limits.

2) Control equipment sends two control messages within cease time to EUT:

   a) The second control message shall be sent still within the cease time of the first control message (=EUT trigger).

b) Measure TBT timeout and cumulated ON-time at EUT UWB radio interface, relative to the start of the first EUT transmission.

c) The second control message shall be ignored and shall not lead to further transmissions by the EUT. The measured values shall comply with the Trigger-before-transmit limit and are expected to be the same as in 1).

3) Companion device sends response packets:

a) Control equipment sends control message to EUT as initial trigger.

b) EUT sends one or more transmissions.

c) The companion device shall send responses to the EUT.

d) Verify at EUT control interface that response packets are received.

e) Measure cumulated ON-time T_{cum_on} within any 10 s.

f) The maximum value for T_{cum_on} shall be recorded and shall comply with the Trigger-before-transmit limit.

4) Deactivate response packet transmissions:

a) Verify that EUT stops transmitting.

b) Measure TBT timeout, relative to the last received UWB packet.

c) The larger value of 1b or 4b shall be recorded as result for $TBT_{timeout}$ and shall comply with the limit.

The test procedure shall include at least 10 response packets, before deactivating the companion device.
Evaluation of at least 10 response packets shall confirm identical behaviour of the EUT or reveal worst-case behaviour.

The observation time after the (latest) trigger shall be at least 1 min to confirm that the EUT has ceased UWB transmissions.

5.3.8 TX behaviour under the complete environmental profile

5.3.8.1 General

A test set-up shall be chosen based on clause 4.3.1 and Figure 1 in ETSI TS 103 941 [3].

5.3.8.2 Conformance test procedure

The procedure according to ETSI TS 103 941 [3], clause 6.4 shall be used.

Based on clause 5.1.3 and Figure 6 of ETSI TS 103 941 [3], clause 4.5.4 the parameters for the assessment are specified as follow:

- t_{low}: see clause 5.1.3, Table 14
- t_{high}: see clause 5.1.3, Table 14
- t_{steps}: 10 °C
- supply voltage: see clause 5.1.3, the nominal value of the supply voltage is usually provided by the user manual of the EUT.

5.4 Conformance methods of measurement for receiver

5.4.1 Receiver spurious emissions

Receiver spurious emissions shall be measured radiated using a test setup according to ETSI EN 303 883-1 [1], clause B.2 ("Radiated measurements").

For the test, the EUT shall be set into the RX mode.

For the Receiver spurious emission conformance test the conformance test procedure as specified in ETSI EN 303 883-2 [2], clause 5.2.3 shall be used.

The pre-scan measurement (step 1 as specified in ETSI EN 303 883-2 [2], clause 5.2.3.2) shall be performed at the same distance and step width as for the Mean e.i.r.p. spectral density conformance test (see clause 5.3.3).

The measured results of the Receiver spurious emission measurements and the used measurement distance and angular steps shall be recorded.

5.4.2 Receiver Baseline Sensitivity (RBS)

Conformity of Receiver Baseline Sensitivity shall be a radiated test with integral or specified antenna according to ETSI EN 303 883-2 [2], clause 5.4.3.3 ("Radiated measurements for radio communication devices with power limit").

All signal levels (P_{out}, $P_{@EUT}$) shall be determined with reference to the Mean e.i.r.p. spectral density and therefore documented with the unit "dBm/MHz".

The wanted technical performance criteria for the test are provided in clause 4.4.2.1.

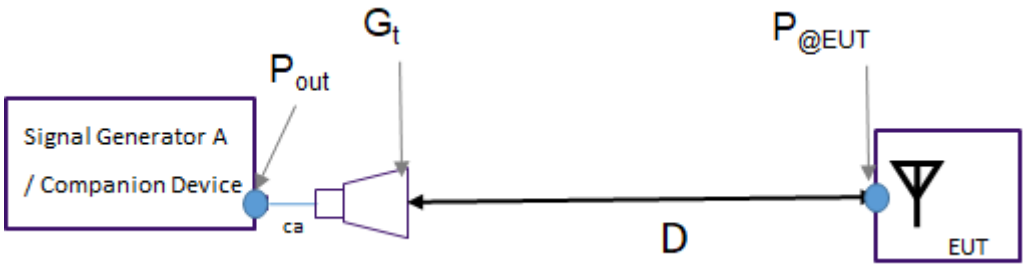

Figure 9: Setup for RBS measurement

The recommended measurement distance D is 3 m.

5.4.3 Receiver Baseline Resilience (RBR)

Conformity of Receiver Baseline Resilience shall be tested according to ETSI EN 303 883-2 [2], clause 5.5.3.3 ("Radiated Measurements for Radio Communication Devices with Power Limit") with the following parameters:

The wanted technical performance criteria for the test are provided in clauses 4.4.2.1 and 4.4.2.2.

The wanted signal level for all RBR tests shall be 10 dB above the Receiver Baseline Sensitivity (see clause 4.4.4.3).

Sensitivity degradation d_g = 10 dB

The wanted signal shall be at its nominal frequency f_c.

Interfering signals within OFR are given in Table 12 and Interfering signals outside OFR in Table 13.

For interference scenario 2 the interference shall be present for 10 seconds. After 11 seconds the MSR measurement is started again and the EUT shall fulfil message success rate better than 90 %.

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

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] 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.8].

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.

Table A.1: Relationship between the present document and the essential requirements of Directive 2014/53/EU

Harmonised Standard ETSI EN 302 065-3-1					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Operating Frequency Range (OFR)	3.2	4.3.2	U	
2	Mean e.i.r.p. spectral density	3.2	4.3.3	U	
3	Peak e.i.r.p. spectral density	3.2	4.3.4	U	
4	TX unwanted emissions	3.2	4.3.5	U	
5	Duty Cycle	3.2	4.3.6	C	EUT categories 1A, 1B and 2A
6	Trigger-before-transmit	3.2	4.3.7	C	EUT categories 1A and 1B
7	TX behaviour under the complete environmental profile	3.2	4.3.8	U	
7	Receiver spurious emissions	3.2	4.4.3	C	EUTs comprise an RX only mode
8	Receiver Baseline Sensitivity (RBS)	3.2	4.4.4	U	
9	Receiver Baseline Resilience (RBR)	3.2	4.4.5	U	

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement.

Description A textual reference to the requirement.

Essential requirements of Directive

Identification of article(s) defining the requirement in the Directive.

Clause(s) of the present document

Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement is or is not applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (informative): Selection of technical parameters

ETSI EG 203 336 [i.13], clause 5 lists the technical parameters applicable to transmitters and receivers that should be considered when producing Harmonised Standards that are intended to cover the essential requirements in article 3.2 of Directive 2014/53/EU [i.1]. Essential requirements are high level objectives described in European Directives. The purpose of the Harmonised Standard is to translate those high-level objectives into detailed technical specifications. Table B.1 contains the transmitter parameters and Table B.2 contains the receiver parameter listed in ETSI EG 203 336 [i.13], clause 5 for transmitter and receiver, and cross references these to the clauses within the present document in which the requirements for measurement of such parameters are satisfied or justified.

Table B.1: Cross reference of clauses in the present document to technical parameters for transmitter listed in ETSI EG 203 336 [i.13]

ETSI EG 203 336 [i.13]		Present document		Justification
Clause	**Parameter**	**Clause**	**Parameter**	
5.2.2	Transmitter power limits	4.3.3	Mean e.i.r.p spectral density	
		4.3.4	Peak e.i.r.p. spectral density	
		4.3.8	TX behaviour under the complete environmental profile	
5.2.3	Transmitter power accuracy	-	-	From the latest version of ETSI EG 203 336 [i.13]. *"When regulatory limits imply only a maximum emission limit (e.g. products that operate under a general licence regime), this parameter need not be considered for inclusion in an HS."*
5.2.4	Transmitter spectrum mask	4.3.2 4.3.8	Operating Frequency Range TX behaviour under the complete environmental profile	
5.2.5	Transmitter frequency stability	4.3.8	TX behaviour under the complete environmental profile	
5.2.6	Transmitter intermodulation attenuation	-	-	From latest version of ETSI EG 203 336 [i.13]. This parameter is required only "where high levels of quality services are required". This is not relevant for generic short range devices which are operating under licence except regime without any kind of regulatory protection. SRDs have to accept interferences.
5.2.7.2	Transmitter unwanted emissions in the out of band domain	4.3.5	TX unwanted emissions	
5.2.7.3	Transmitter unwanted emissions in the spurious domain	4.3.5	TX unwanted emissions	
5.2.8	Transmitter time domain characteristics	4.3.6	Duty cycle	Only applicable for equipment types 1A, 1B and 2A
5.2.9	Transmitter transients	-	-	Not applicable.
	Other mitigation, spectrum access requirements not specified in the ETSI Guide but specified in related ECC/EC framework	4.3.7	Trigger-before-transmit	Only applicable for equipment types 1A and 1B.

Table B.2: Cross reference of clauses in the present document to technical parameters for receiver listed in ETSI EG 203 336 [i.13]

ETSI EG 203 336 [i.13]		Present document		Justification
Clause	**Parameter**	**Clause**	**Parameter**	
5.3.2	Receiver sensitivity	-	not specified, superseded by RBS test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.2.3	Desensitization	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.3	Receiver co-channel rejection	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.4.2.1	Receiver adjacent channel selectivity	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.4.2.2	Receiver adjacent band selectivity	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.4.3	Receiver blocking	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.4.4	Receiver spurious response rejection	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.4.5	Receiver radio-frequency intermodulation	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.5	Receiver unwanted emissions in the spurious domain	4.4.3	Receiver spurious emissions	*Applicable for all EUT with RX only mode.*
5.3.6.1	Receiver dynamic range	-	partly by RBS	See ETSI EN 303 883-2 [2], Table C.1 [2].
5.3.6.2	Reciprocal mixing	-	not specified, superseded by RBR test	See justification in ETSI EN 303 883-2 [2], annex C and the explanation of the interferer signal handling concept, see ETSI TS 103 567 [i.14].
5.3.1	Signal interferer handling	4.4.4 4.4.5	Receiver Baseline Sensitivity (RBS) Receiver Baseline Resilience (RBR)	Interferer signal handling (ETSI EG 203 336 [i.13] clause 5.3.1) is an alternative method for specifying receiver parameters intended for use for receivers such as UWB and certain types of radar equipment. The present document is following this concept, see ETSI TS 103 567 [i.14] and ETSI EN 303 883-2 [2].

Annex C (informative): Trigger-before-transmit

C.1 Trigger behaviour

This clause explains the trigger behaviour of the equipment with respect to category A and B as defined in ETSI TR 103 416 [i.3].

ETSI TR 103 416 [i.3], clause 5.2 defines different categories of vehicular access systems:

- Category A (Proximity Verification)
- Category B (Proximity Monitoring)

ECC Report 278 [i.6] concludes that compatibility with incumbent services can be reached for those categories A and B by using "trigger-before-transmit" mitigation.

Upon a trigger event the behaviour of the EUT can be characterized as follows (and mapped to category A or B equipment, referencing ETSI TR 103 416 [i.3], clauses 5.2.2 and 5.2.3):

- Case A: EUT follows a pre-defined sequence of transmissions, independent whether it receives (further) UWB packets of the companion device or not;
  this will be the typical behaviour of Category A equipment.
- Case B: EUT continues transmitting UWB packets, as long as it receives packets from the companion device; if no packets are received any more (companion device is out of range), EUT will stop UWB transmissions;
  this will be the typical behaviour of Category B equipment.

Figure C.1 gives an overview about the EUT trigger scenarios with respect to case A and case B.

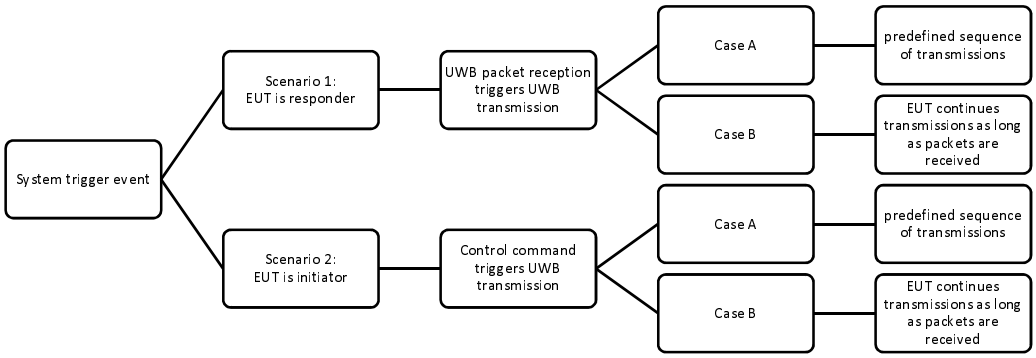

Figure C.1: Trigger behaviour for Category A and Category B

As regulation ECC/DEC/(06)04 [i.4] does not differentiate between categories, limits in clause 4.3.7.3 and conformance test in clause 4.3.7.4 cover both, category A and B.

C.2 Justification for trigger-before-transmit limits

ECC Report 278 [i.6] connects two essential assumptions with "trigger-before-transmit" mitigation:

1) The cumulated transmission time of the EUT upon a trigger event is limited.
2) The overall activity of a "Trigger-before-transmit" EUT is lower than for a worst-case LDC device.

Taking these assumptions as requirements to be covered in a measurement procedure, following conclusions can be made:

1) The requirement of a cumulated transmission time can be measured on EUT level.

2) Activity cannot be measured on EUT level, as it is controlled by entities outside the EUT and depends on usage profile. However, a necessary consequence of "trigger-before-transmit" is that the EUT ceases UWB transmissions within a certain time upon a trigger event.
The requirement of a transmission cease time can be measured on EUT level.

ECC Report 278 [i.6], Table 4 defines UWB system parameters used for the studies on the "Trigger-Before-Talk" mitigation. The cumulated T_{on} time per trigger event is assumed to be:

- 50 ms for Category A devices.
- 750 ms for Category B devices.

Furthermore, EUTs should comply with the LDC regulations:

- Assuming a Duty-Cycle of 5 % (Short-Term Duty-Cycle limit, T_{on} = 50 ms if applied to 1 second observation time) the cumulated T_{on} time is achieved:
  - for Category A (50 ms) within 1 s of operation;
  - for Category B (750 ms) within 15 s of operation.
- Assuming a Duty-Cycle of 0,5 % (Long-Term Duty-Cycle limit, T_{on} = 5 ms if applied to 1 second observation time) the cumulated Ton time is achieved:
  - for Category A (50 ms) within 10 s of operation;
  - for Category B (750 ms) within 150 s of operation.

Thus, a test on ceasing transmission within 10 s AND not exceeding a cumulated T_{on} of 50 ms within 10 s would satisfy the "trigger-before-transmit" as well as the Long-Term Duty-Cycle requirement, and is reflecting the lower activity assumptions for Category A.

Annex D (informative): RBR Limits Derivation

D.1 General

The RBR limits in the present document are derived based on ETSI EN 303 883-2 [2], annex A.

Clause A.2.1.1 of ETSI EN 303 883-2 [2] is referencing to ETSI TS 103 361 [i.5], which includes the list of interferers from which the highest interferer for the in-band and out-of-band test is chosen.

The interferers from Table 7 of ETSI TS 103 361 [i.5], clause 7.6 ("Interferers for mobile (indoor and outdoor) applications") are evaluated for the two permitted frequency ranges of the present document and the highest level is taken as the limit.

This is the worst-case for all possible OFR scenarios.

D.2 Relevant interferers - Frequency Band 3,8 GHz to 4,2 GHz

D.2.1 Relevant interferers

Maximum possible OFR: f_L = 3,8 GHz, f_H = 4,2 GHz → OFR_{max} = 0,4 GHz, f_c = 4,0 GHz.

For this OFR Table 1 of ETSI TS 103 361 [i.5], clause 7.2 ("Complete list of interferers") does not list any relevant interferers.

D.2.2 Limits for Equipment Type 1

Same limit as for frequency band 6,0 GHz to 8,5 GHz is used: $P_{@EUT}$ = -85 dBm.

D.2.3 Limits for Equipment Type 2

Same limit as for frequency band 6,0 GHz to 8,5 GHz is used: $P_{@EUT}$ = -75 dBm.

D.3 Relevant interferers - Frequency Band 6,0 GHz to 8,5 GHz

D.3.1 Relevant interferers

Maximum possible OFR: f_L = 6,0, f_H = 8,5 GHz → OFR_{max} = 2,5 GHz, f_c = 7,25 GHz.

From Table 1 of ETSI TS 103 361 [i.5], clause 7.2 ("Complete list of interferers") the relevant interferers can be identified.

Table D.1 lists the relevant interferers.

Table D.1: List of relevant interferers

Radio Service	Frequence Minimum [MHz]	Frequence Maximum [MHz]	Centre Frequence [MHz]	Maximum EIRP [dBm]	Channel BW [MHz]	Duty cycle
Radiodetermination applications	4 500	7 000	5 725	24	2 500	
Fixed links	5 925	8 500	7 212,5	85	29,65	
Radiodetermination applications	6 000	8 500	7 250	7	2 500	100 %
Fixed (point-to-point)	8 400	8 500	8 450	85		

D.3.2 Limits for Equipment Type 1

ETSI TS 103 361 [i.5], clause 7.8 ("Interferers for automotive applications") defines interference power for "Devices inside the surface and not in the passenger area" in Table 13 and "Devices outside the surface or within the passenger area" in Table 15.

Table 15 of ETSI TS 103 361 [i.5] provides the tougher values and is used for all Equipment Type 1 (independent of its packaging location) to derive a worst-case limit.

The interference power levels out of Table 15 of ETSI TS 103 361 [i.5] for the relevant interferers (as determined in Table D.1) are listed in Table D.2.

Table D.2: List of interferers for Equipment Type 1

Radio Service	Centre Frequency [MHz]	Maximum EIRP [dBm]	Service group	Total attenuation [dB]	Power @ device [dBm]	Channel BW [MHz]	Duty cycle
Fixed links	7 212,5	85		170	-85	29,65	
Radiodetermination applications	7 250	7	4	132	-125	2 500	1
Fixed (point-to-point)	8 450	85		171	-86		

The worst-case value is -85 dBm which is defined as the limit for Equipment Type 1 in the frequency band 6,0 GHz to 8,5 GHz.

D.3.3 Limits for Equipment Type 2

ETSI TS 103 361 [i.5], clause 7.6 ("Interferers for mobile (indoor and outdoor) applications") defines interference power levels for mobile devices in Table 7.

The interference power levels out of Table 7 of ETSI TS 103 361 [i.5] for the relevant interferers (as determined in Table D.1) are listed in Table D.3.

Table D.3: List of interferers for Equipment Type 2

Radio Service	Centre Frequency [MHz]	Maximum EIRP [dBm]	Service group	Total attenuation [dB]	Power @ device [dBm]	Channel BW [MHz]	Duty cycle
Radiodetermination applications	5 750	24	4	118	-94	2 500	
Fixed links	7 212,5	85		160	-75	29,65	
Radiodetermination applications	7 250	7	4	120	-113	2 500	1
Fixed (point-to-point)	8 450	85		161	-76		

The worst-case value is -75 dBm which is defined as the limit for Equipment Type 2 in the frequency band 6,0 GHz to 8,5 GHz.

D.4 Strong interferers

D.4.1 WAS/RLAN in 5 925 MHz to 6 425 MHz

VLP devices may be introduced to the market with maximum e.i.r.p. for in-band emissions of +14 dBm, see ECC/DEC/(20)/01 [i.11].

Applying the conditions for mobile interferers (service group 1) from ETSI TS 103 361 [i.5] for the total attenuation yields:

Total attenuation [dB]	= Path loss for 2 m [dB]	+ Wall loss [dB]	+ Additional loss NLOS [dB]	
	= 54 dB	+ 0 dB	+ 10 dB	= 64 dB

The resulting interferer power at a UWB device with 0 dBi antenna is:

interferer power@device [dBm] = max. e.i.r.p. interferer [dBm] - Total attenuation [dB] = +14 dBm - 64 dB = -50 dBm

D.4.2 Limits for Equipment Type 1 and Equipment Type 2

The interference power for VLP devices as derived in clause D.4.1 is considered to be representative for any "strong" interferers that may appear in the field.

This value will be used across all equipment types and frequency bands as test limit, for which the EUT needs to fulfil Wanted Technical Performance Criterion 2: A temporary loss of function may occur, but the EUT automatically recovers its normal performance once the interference has ceased.

The limit for Equipment Type 1 and Type 2 is -50 dBm for frequency bands 3,8 GHz to 4,2 GHz as well as 6,0 GHz to 8,5 GHz.

Annex E (informative): Bibliography

ERC/REC 70-03: "ERC Recommendation of 1997 on relating to the use of Short Range Devices (SRD)".

2013/752/EU: Commission Implementing Decision of 11 December 2013 amending Decision 2006/771/EC on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2005/928/EC (notified under document C(2013) 8776) Text with EEA relevance.

CEPT/ERC/Recommendation 74-01E: "Unwanted emissions in the spurious domain".

Recommendation ITU-R SM.329-12 (2012): "Unwanted emissions in the spurious domain".

ETSI TS 103 060 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Method for a harmonized definition of Duty Cycle Template (DCT) transmission as a passive mitigation technique used by short range devices and related conformance test methods".

Annex F (informative): Change history

Version	Information about changes
1.1.1	Last publication of ETSI EN 302 065-3 for UWB devices for road and rail vehicles as HS under Directive 1999/5/EC (RTTE).
2.1.1	Revision of ETSI EN 302 065-3 for UWB devices for road and rail vehicles for compliance with Directive 2014/53/EU; listed in OJEU on 10 March 2017 and listed with restrictions (not for trigger-before-transmit) at 6 February 2020; main changes to previous version: • Outsourcing of standard measurement procedure into separate ETSI EN 303 883 (V1.1.1) • More detailed description of receiver spurious emission requirements • New requirement on receiver interferer signal handling • New Annex B "Application form for testing" • New Annex C "Equivalent mitigation techniques" • New Annex D "Surface mounted devices example mirror" • New Annex E "Device mounted inside the tyre"
ETSI EN 302 065-3-1	
3.2.1	Revision on request of the EC to improve the standard, especially regarding receiver requirements; to achieve sound a clear standards it was decided in TGUWB to develop more specific standards; for the present document this means instead of one ETSI EN 302 065-3 standard for all for road and rail vehicles a ETSI EN 302 065-3-1 for UWB devices for vehicular access systems. Other sub-parts may follow. • The scope was limited to: UWB devices for vehicular access systems within 3,8 GHz to 4,2 GHz or 6 GHz to 8,5 GHz The revision clarified: • EUT categories covered by the EN with the related technical requirements • Receiver requirements and the related wanted technical performance requirements • Conformance testing under the environmental profile specification

History

Document history			
V1.1.1	April 2014	Publication as ETSI EN 302 065-3	
V2.1.1	November 2016	Publication as ETSI EN 302 065-3	
V3.1.0	July 2021	EN Approval Procedure	AP 20211024: 2021-07-26 to 2021-10-25
V3.1.1	July 2024	SRdAP process	EV 20241010: 2024-07-12 to 2024-10-10
V3.2.0	December 2024	SRdAP process	VA 20250218: 2024-12-20 to 2025-02-18
V3.2.1	February 2025	Publication	