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HARMONISED EUROPEAN STANDARD

**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**

Reference

REN/ERM-TGUWB-130

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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.13] 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 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.12].

National transposition dates	
Date of adoption of this EN:	18 July 2016
Date of latest announcement of this EN (doa):	31 October 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 April 2017
Date of withdrawal of any conflicting National Standard (dow):	30 April 2018

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.

1 Scope

The present document applies to transceivers, transmitters and receivers utilizing Ultra Wide Band (UWB) technologies and used for short range applications in road and rail vehicles, which includes devices mounted inside or at the surface. The present document applies to impulse, modified impulse and RF carrier based UWB technologies in the main operating frequency ranges from 3,1 GHz to 4,8 GHz or from 6 GHz to 9 GHz.

Examples of applications for road and rail vehicles are:

- stand-alone radio equipment with or without its own control provisions;
- plug-in radio devices intended for use with, or within, a variety of host systems, e.g. personal computers, etc.;
- plug-in radio devices intended for use within combined equipment, e.g. modems, access points, etc.;
- equipment for telemetry communication inside and outside of road and rail vehicles;
- equipment for the localization of devices inside and outside of road and rail vehicles (e.g. hand-held devices);
- equipment to investigate materials (e.g. fuel).

The present document does not apply to fixed road infrastructure installations. For fixed rail infrastructure tracking applications see ETSI TR 101 538 [i.10] and ETSI TS 103 085 [i.11].

NOTE: As per the ECC/DEC/(06)04 [i.2] and Decision 2014/702/EC [i.4] the UWB transmitter equipment conforming to the present document is not to be installed at a fixed outdoor location, for use in flying models, aircraft and other forms of aviation. The present document applies to UWB equipment with an output connection used with a dedicated antenna or UWB equipment with an integral antenna.

Equipment covered by the present document operates in accordance with ECC/DEC(06)04 [i.2].

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

Table 1: Permitted range and intended range of operation [i.4]

Permitted range of operation (note 1)	
Transmit	30 MHz to 10,6 GHz
Receive	30 MHz to 10,6 GHz
Intended ranges of operation (note 2)	
Transmit	3,1 GHz to 4,8 GHz
Receive	3,1 GHz to 4,8 GHz
Transmit	6,0 GHz to 9 GHz
Receive	6,0 GHz to 9 GHz

NOTE 1: Limits in table 2, clause 4.3.2 and table 3, clause 4.3.3 are to be met.
NOTE 2: This is the preferred range for the operating bandwidth, as defined in clause 4.3.1.

The present document does not apply to radio equipment for which a specific Harmonised EN applies as such. Harmonised EN may specify additional EN requirements relevant to the presumption of conformity under article 3.2 of the Radio Equipment Directive (Directive 2014/53/EU) [i.1].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

- [1] ETSI EN 303 883 (V1.1.1) (09-2016): "Short Range Devices (SRD) using Ultra Wide Band (UWB); Measurement Techniques".
- [2] ETSI TS 102 754 (V1.3.1) (03-2013): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Technical characteristics of Detect And Avoid (DAA) mitigation techniques for SRD equipment using Ultra Wideband (UWB) technology".
- [3] ETSI TS 103 361 (V1.1.1) (03-2016): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Receiver technical requirements, parameters and measurement procedures to fulfil the requirements of the Directive 2014/53/EU".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] 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.2] CEPT ECC/DEC/(06)04 of 24 March 2006 amended 9 December 2011: "The harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz".
- [i.3] ECC Report 120 (March 2008): "ECC Report on Technical requirements for UWB DAA (Detect and avoid) devices to ensure the protection of radiolocation in the bands 3.1-3.4 GHz and 8.5-9 GHz and BWA terminals in the band 3.4-4.2 GHz".
- [i.4] Commission Decision 2014/702/EU of 7 October 2014 amending Decision 2007/131/EC on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (notified under document C(2014) 7083).
- [i.5] CEPT/ERC Recommendation 74-01: "Unwanted emissions in the spurious domain".
- [i.6] 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.7] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [i.8] ETSI TR 102 070-2 (V1.1.1) (11-2002): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide to the application of harmonized standards to multi-radio and combined radio and non-radio equipment; Part 2: Effective use of the radio frequency spectrum".
- [i.9] ETSI TR 103 086 (V1.1.1) (03-2013): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Conformance test procedure for the exterior limit tests in EN 302065-3 UWB applications in the ground based vehicle environment".
- [i.10] ETSI TR 101 538: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); UWB location tracking devices in the railroad environment".

- [i.11] ETSI TS 103 085: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB) for Location and Tracking railroad applications; RF conformance testing".
- [i.12] ETSI EN 302 065-1 (V2.1.0) "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Requirements for Generic UWB applications".
- [i.13] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

transmitter off time: time interval between two consecutive bursts when the UWB emission is kept idle

transmitter on time: duration of a burst irrespective of the number of pulses contained

3.2 Symbols

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

d	distance
k	coverage factor
φ	azimuth angle

3.3 Abbreviations

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

CEPT	European Conference of Postal and Telecommunications Administrations
NF	Noise Figure

4 Technical requirements specifications

4.1 Environmental conditions

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile. The normal test conditions are defined in clause 5.4.3 of ETSI EN 303 883 [1].

4.2 General

UWB devices in the scope of the present document can operate in a broad permitted range of frequencies from 30 MHz to 10,6 GHz, as defined in table 1 of the present document. The intended range of operation gives the preferred range of operating bandwidth for the UWB operation based on the allowed spectrum mask with increased permitted emission levels in the intended range of operation.

In order to clearly identify the required limits and thus measurement procedures it is essential to define the operating bandwidth of the UWB DUT. The operating bandwidth of the UWB DUT test shall be the -10 dB bandwidth of the intended UWB signal under normal operational conditions as defined in ETSI EN 303 883 [1], clause 5.4.3.

A single UWB device can have more than an operating bandwidth. The basic concept is described in figure 1. Here two separate operating bandwidths are depicted, one with a UWB operating bandwidth in the lower frequency range (< 6 GHz) and one in the upper frequency range (> 6 GHz). All UWB related emissions shall be measured in the identified operating bandwidth(s) of the UWB device under test. The required mitigation techniques are only valid in the operating bandwidth(s).

The RX interference signal handling is focused in the operating bandwidth and some clearly identified frequencies outside the operating bandwidth(s), see clause 4.4.3.

TE: Total emission including UWB emission (mean power spectral density) and Other Emissions (OE) (e.g. RX spurious, TX spurious and unwanted emission not belonging to the UWB emissions), see clause 7.3 of ETSI EN 303 883 [1].

The peak power limit shall only be measured at the frequency and the direction with the highest mean power spectral density.

OE emission shall only be considered in the operating bandwidth if the given UWB limits (UE limits for mean power and peak power) are not met. In this case OE shall be clearly identified.

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



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

4.3 Transmitter Conformance Requirements

4.3.1 Operating Bandwidth

4.3.1.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.1.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.2 applies.

4.3.1.3 Limits

Any operating bandwidth of all the DUT shall lie within one permitted frequency range of operation of the device (see table 1) and shall be > 50 MHz.

4.3.1.4 Conformance

The conformance test suite for operating bandwidth shall be as defined in clause 6.5.3.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.2 Maximum Value of Mean Power Spectral Density

4.3.2.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.2.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.3 applies.

4.3.2.3 Limits

The maximum mean power spectral density shall not exceed the limits given in table 2.

**Table 2: Maximum value of mean power spectral density limit (e.i.r.p.)
(Commission Decision 2014/702/EU [i.4])**

Frequency range [GHz]	Without mitigation techniques	With mitigation techniques
$f \leq 1,6$	-90 dBm/MHz	-90 dBm/MHz
$1,6 < f \leq 2,7$	-85 dBm/MHz	-85 dBm/MHz
$2,7 < f \leq 3,1$	-70 dBm/MHz	-70 dBm/MHz
$3,1 < f \leq 3,4$	-70 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$3,4 < f \leq 3,8$	-80 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$3,8 < f \leq 4,2$	-70 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$4,2 < f \leq 4,8$	-70 dBm/MHz	-41,3 dBm/MHz (notes 1 and 2)
$4,8 < f \leq 6$	-70 dBm/MHz	-70 dBm/MHz
$6 < f \leq 8,5$	-53,3 dBm/MHz	-41,3 dBm/MHz (notes 1 and 3)
$8,5 < f \leq 9$	-65 dBm/MHz	-41,3 dBm/MHz (note 2)
$9 < f \leq 10,6$	-65 dBm/MHz	-65 dBm/MHz
$10,6 < f$	-85 dBm/MHz	-85 dBm/MHz

NOTE 1: Within the band 3,1 GHz to 4,8 GHz and 6 GHz to 8,5 GHz, devices implementing Low Duty Cycle (LDC) mitigation technique (see clause 4.5.3) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. Operation is in addition subject to the implementation of an exterior limit (see clause 4.3.4) of -53,3 dBm/MHz.

NOTE 2: Within the bands 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz, devices implementing Detect And Avoid (DAA) mitigation technique (see clause 4.5.1) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. Operation is in addition subject to the implementation of Transmit Power Control (TPC) mitigation technique (see clause 4.6) and an exterior limit (see clause 4.3.4) of -53,3 dBm/MHz.

NOTE 3: Within the band 6 GHz to 8,5 GHz devices implementing Transmit Power Control (TPC) mitigation technique (see clause 4.7.1) and an exterior limit (see clause 4.3.4) of -53,3 dBm/MHz are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz.

4.3.2.4 Conformance

The conformance test suite for maximum value of mean power spectral density shall be as defined in clause 6.5.4.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.3 Maximum value of peak power

4.3.3.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.3.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.4 applies.

4.3.3.3 Limits

The maximum peak power limit measured shall not exceed the limits given in table 3.

Table 3: Maximum peak power limit (CEPT report 45 [i.6])

Frequency range [GHz]	Without mitigation techniques (defined in 50 MHz)	With mitigation techniques (defined in 50 MHz)
$f \leq 1,6$	-50 dBm	-50 dBm
$1,6 < f \leq 2,7$	-45 dBm	-45 dBm
$2,7 < f \leq 3,1$	-36 dBm	-36 dBm
$3,1 < f \leq 3,4$	-36 dBm	0 dBm (notes 1 and 2)
$3,4 < f \leq 3,8$	-40 dBm	0 dBm (notes 1 and 2)
$3,8 < f \leq 4,2$	-30 dBm	0 dBm (notes 1 and 2)
$4,2 < f \leq 4,8$	-30 dBm	0 dBm (notes 1 and 2)
$4,8 < f \leq 6$	-30 dBm	-30 dBm
$6 < f \leq 8,5$	-13,3 dBm	0 dBm (notes 1 and 3)
$8,5 < f \leq 9$	-25 dBm	0 dBm (note 2)
$9 < f \leq 10,6$	-25 dBm	-25 dBm
$10,6 < f$	-45 dBm	-45 dBm

NOTE 1: Within the band 3,1 GHz to 4,8 GHz and 6 GHz to 8,5 GHz, devices implementing Low Duty Cycle (LDC) mitigation technique (see clause 4.5.3) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. Operation is in addition subject to the implementation of an exterior limit (see clause 4.3.4) of -53,3 dBm/MHz.

NOTE 2: Within the bands 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz, devices implementing Detect And Avoid (DAA) mitigation technique (see clause 4.5.1) are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. Operation is in addition subject to the implementation of Transmit Power Control (TPC) mitigation technique (see clause 4.6) and an exterior limit (see clause 4.5) of -53,3 dBm/MHz.

NOTE 3: Within the band 6 GHz to 8,5 GHz devices implementing Transmit Power Control (TPC) mitigation technique (see clause 4.7.1) and an exterior limit (see clause 4.3.4) of -53,3 dBm/MHz are permitted to operate with a maximum mean e.i.r.p. spectral density of -41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz.

4.3.3.4 Conformance

The conformance test suite for maximum value of peak power shall be as defined in clause 6.5.5.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.4 Exterior Limits

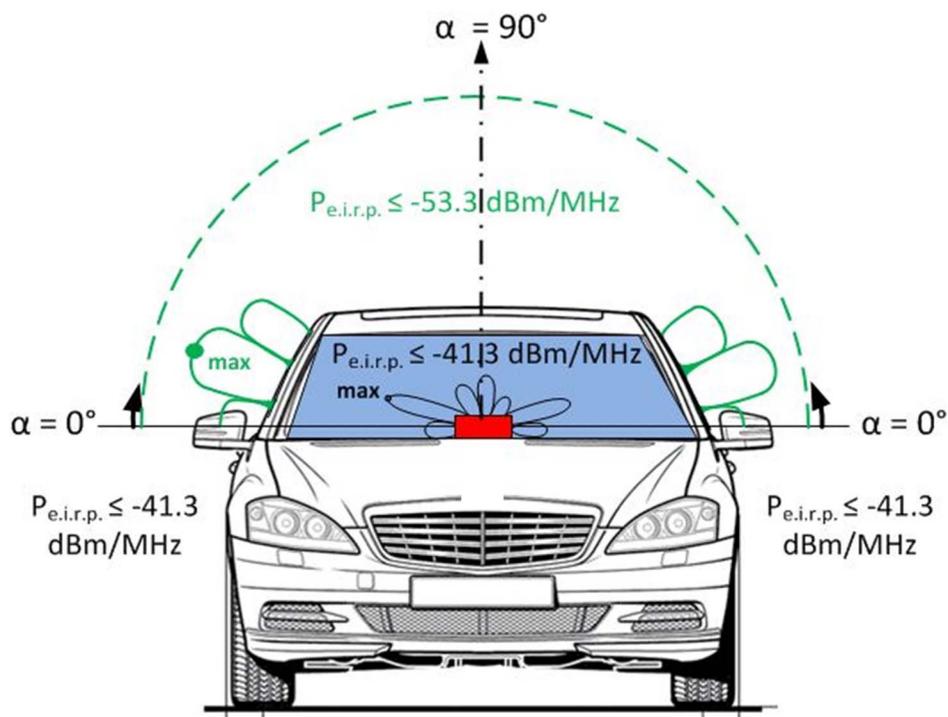
4.3.4.1 Applicability

This requirement shall apply to all devices that implement the Exterior Limits to avail of the relaxed limits in table 2 (clause 4.3.2) and/or table 3 (clause 4.3.3).

4.3.4.2 Description

The exterior limit is defined, for each UWB device installed in a road or rail vehicle, as the maximum mean e.i.r.p. spectral density for the emissions outside the vehicle at elevation angles higher than 0 degree (Commission Decision 2014/702/EU [i.4] and CEPT report 45 [i.6]).

The reference plane for the 0 degree is the sensor mounting height. Figure 2 shows the principle of these regulations.



NOTE: The exterior limit refers to the maximum mean spectral density e.i.r.p. measured outside the vehicle and every local maximum should be below the limits.

Figure 2: Principle of the regulations (CEPT Report 45 [i.6])

4.3.4.3 Limits

Within the bands 3,1 GHz to 4,8 GHz, 6 GHz to 8,5 GHz and 8,5 GHz to 9 GHz, an exterior limit shall not exceed, see table 4.

Table 4: The exterior limit refers to the maximum mean spectral density e.i.r.p. (Commission Decision 2014/702/EU [i.4])

Frequency range [GHz]	Exterior limit $0^\circ < \alpha \leq 90^\circ$	Exterior limit $0^\circ \geq \alpha > -90^\circ$
$3,1 < f \leq 3,4$	-53,3 dBm/MHz	-41,3 dBm/MHz
$3,4 < f \leq 3,8$	-53,3 dBm/MHz	-41,3 dBm/MHz
$3,8 < f \leq 4,2$	-53,3 dBm/MHz	-41,3 dBm/MHz
$4,2 < f \leq 4,8$	-53,3 dBm/MHz	-41,3 dBm/MHz
$6 < f \leq 8,5$	-53,3 dBm/MHz	-41,3 dBm/MHz
$8,5 < f \leq 9$	-53,3 dBm/MHz	-41,3 dBm/MHz

4.3.4.4 Conformance

The conformance test suite for exterior limit shall be as defined in clauses 6.5.2 and 6.5.6.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.5 Total Power

This requirement does not apply to any DUT.

4.3.6 Other Emissions

4.3.6.1 Applicability

This requirement shall apply to all transmitting DUT.

4.3.6.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.5 applies.

4.3.6.3 Limits

The equivalent isotropically radiated power of any of these other emissions (OE) in the spurious domain shall not exceed the values given in table 5.

**Table 5: Other Emission limits (radiated)
(CEPT/ERC Recommendation 74-01 [i.5])**

Frequency range	Limit values for OE
47 MHz to 74 MHz	-54 dBm/100 kHz
87,5 MHz to 118 MHz	-54 dBm/100 kHz
174 MHz to 230 MHz	-54 dBm/100 kHz
470 MHz to 862 MHz	-54 dBm/100 kHz
otherwise in band 30 MHz to 1 000 MHz	-36 dBm/100 kHz
1 000 MHz to 40 000 MHz (see note)	-30 dBm/1 MHz
NOTE: Not applicable for UWB emissions within the operating bandwidth.	

4.3.6.4 Conformance

The conformance tests for Other Emissions (OE) shall be as defined in clause 6.5.4.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.3.7 Transmitter Unwanted Emissions

This requirement does not apply to any DUT.

4.4 Receiver Conformance Requirements

4.4.1 General

Detailed description for related UWB receiver requirements, see ETSI TS 103 361 [3].

4.4.2 Receiver spurious emissions

4.4.2.1 Applicability

Receiver spurious emission testing shall apply only when the equipment can work in a receive-only mode or is a receive-only device.

NOTE: Otherwise receiver spurious emissions are measured as part of the other emissions, see clause 4.3.6.

4.4.2.2 Description

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.

4.4.2.3 Limits

The narrowband spurious emissions of the receiver shall not exceed the values in table 6 in the indicated bands (see CEPT/ERC/REC 74-01 [i.5]).

**Table 6: Narrowband spurious emission limits for receivers
(CEPT/ERC Recommendation 74-01 [i.5])**

Frequency range	Limit
30 MHz to 1 GHz	-57 dBm (e.r.p.)
above 1 GHz to 40 GHz	-47 dBm (e.i.r.p.)

The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage.

Wideband spurious emissions shall not exceed the values given in table 7.

**Table 7: Wideband spurious emission limits for receivers
(CEPT/ERC Recommendation 74-01 [i.5])**

Frequency range	Limit
30 MHz to 1 GHz	-47 dBm/MHz (e.r.p.)
above 1 GHz to 40 GHz	-37 dBm/MHz (e.i.r.p.)

4.4.2.4 Conformance

The conformance test suite for receiver spurious emissions shall be as defined in clause 6.6.1.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.4.3 Receiver interference handling

4.4.3.1 Applicability

This requirement shall apply to all receiving DUT.

4.4.3.2 Description

Interferer signal handling, defined as the capability of the device to operate as intended in the presence of interferers, is the receiver parameter for UWB applications.

Operation as intended is evaluated using a performance criterion and an intended level of performance. For common applications, recommended performance criteria and test cases are defined in clause 9.4 of ETSI TS 103 361 [3]. Using the guidelines of clause 5 of ETSI TS 103 361 [3], the manufacturer shall choose an appropriate performance criterion. The performance criterion and the intended level of performance shall be stated in the user manual see clause 9.2.2 of ETSI TS 103 361 [3].

4.4.3.3 Limits

The level of performance of the chosen performance criterion shall meet the minimum requirement defined in the recommended test case, see ETSI TS 103 361 [3]. If no suitable recommended test case is found or the intended level of performance is not defined, the manufacturer shall define an appropriate performance criterion and a level of performance that reflects the typical usage scenario, as defined in ETSI TS 103 361 [3].

4.4.3.4 Conformance

The conformance tests for Interference Signal Handling shall be as defined in clause 6.6.2.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.5 Requirements for Spectrum Access

4.5.1 Detect and Avoid (DAA)

4.5.1.1 Applicability

This requirement shall apply to all devices that implement the DAA mitigation technique to avail of the relaxed limits in note 2 of table 2 (clause 4.3.2.3) and/or note 2 of table 3 (clause 4.3.3.3).

4.5.1.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.8 applies.

4.5.1.3 Limits

DAA parameters sets shall be fulfilled as given in ETSI TS 102 754 [2], annexes A to C.

4.5.1.4 Conformance

The conformance test suite for the detect and avoid (DAA) shall be as defined in clause 6.7.1.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.5.2 Listen-Before-Talk (LBT)

This requirement does not apply to any DUT.

4.5.3 Low Duty Cycle (LDC)

4.5.3.1 Applicability

This requirement shall apply to all devices that implement the LDC mitigation technique to avail of the relaxed limits in note 1 of table 2 (clause 4.3.2.3) and/or note 1 of table 3 (clause 4.3.3.3).

4.5.3.2 Description

The description in ETSI EN 303 883 [1], clause 7.2.9 applies.

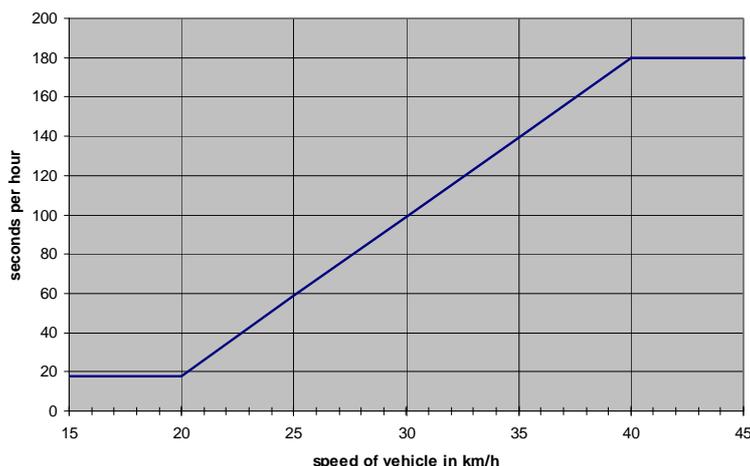
4.5.3.3 Limits

The limits for LDC shall be not exceeded as given in table 8.

Table 8: Baseline limits for low duty cycle (CEPT ECC/DEC/(06)04 [i.2])

Parameter		Limit
Maximum transmitter on time	Ton max	5 ms
Mean transmitter off time	Toff mean	≥ 38 ms (averaged over 1 s)
Sum transmitter off time	∑ Toff	> 950 ms per second
Sum transmitter on time (Long term duty cycle)	∑ Ton	< 18 s per hour (see note)

NOTE: Within the band 3,4 GHz to 4,8 GHz, the long term duty cycle requirement does not apply for operation with vehicle speed above 40 km/h: for vehicle speeds between 20 km/h and 40 km/h a gradual implementation of the long term duty cycle limit from 18 to 180 seconds per hour applies, as shown in figure 3.



NOTE 1: A trade off of transmitted power versus LDC is an equivalent mitigation [i.6], for details see annex C.

NOTE 2: A LDC trade off of transmitted power versus LDC is seen an equivalent mitigation [i.6], for details see annex C.

Figure 3: Long term duty cycle: Sum of transmitter on time with respect to speed of the vehicle (CEPT ECC/DEC/(06)04 [i.2])

4.5.3.4 Conformance

The conformance test suite for Low Duty Cycle shall be as defined in clause 6.7.3.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.6 Antenna Requirements

These requirements do not apply to any DUT.

4.7 Other Requirements and Mitigation techniques

4.7.1 Adaptive / Transmit Power Control (TPC)

4.7.1.1 Applicability

This requirement shall apply to all devices that implement the TPC mitigation technique to avail of the relaxed limits in table 2 (clause 4.3.2) and/or table 3 (clause 4.3.3).

4.7.1.2 Description

Transmit Power Control (TPC) is a mechanism to be used to ensure an interference mitigation on the aggregate power from a large number of radio devices. The TPC mechanism shall provide the full range from the highest to the lowest power level of the radio device.

4.7.1.3 Limits

Devices implementing TPC shall fulfil at least a dynamic range of 12 dB (mean e.i.r.p. range from -41,3 dBm/MHz to -53,3 dBm/MHz).

4.7.1.4 Conformance

The conformance test suite for TPC shall be as defined in clause 6.9.1.

Conformance shall be established under normal test conditions see clause 4.1.

The interpretation of the results for the measurements uncertainty shall be as given in clause 5.3.

4.7.2 Activity factor

These requirements do not apply to any DUT covered by the present document.

4.7.3 Frequency Domain Mitigation

These requirements do not apply to any DUT covered by the present document.

4.7.4 Shielding effects

These requirements do not apply to any DUT covered by the present document.

4.7.5 Thermal Radiation

These requirements do not apply to any DUT covered by the present document.

4.7.6 Site registration

These requirements do not apply to any DUT covered by the present document.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at one or more representative point(s) within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

5.2 General conditions for testing

5.2.1 Product information

The requirements for the product information shall be as given in ETSI EN 303 883 [1], clause 5.2.

An application form for the DUT testing is provided in annex B.

5.2.2 Requirements for the test modulation

The provisions of ETSI EN 303 883 [1], clause 5.3 shall apply.

5.2.3 Test conditions, power supply and ambient temperatures

The provisions of ETSI EN 303 883 [1], clause 5.4 shall apply.

5.2.4 Choice of equipment for test suites

The provisions of ETSI EN 303 883 [1], clause 5.5 shall apply.

5.2.5 Multiple Operating bandwidths and multiband equipment

Where equipment has more than one operating bandwidth (e.g. 500 MHz and 1 300 MHz), a minimum of two operating bandwidths shall be chosen such that the lower and higher limits of the operating range(s) of the equipment are covered, see clause 4.3.1. All operating bandwidths of the equipment shall be declared by the equipment manufacturer.

In case of multiband equipment (i.e. equipment that can operate with an operating bandwidth below 4,8 GHz and above 6,0 GHz), the lowest and highest channel in operation of each band shall be tested.

5.2.6 Testing of host connected equipment and plug-in radio devices

The provisions of ETSI EN 303 883 [1], clause 5.6 shall apply.

5.3 Interpretation of the measurement results

5.3.0 General

Interpretation of the measurement results shall be as given in ETSI EN 303 883 [1], clause 5.7.

5.3.1 Measurement uncertainty is equal to or less than maximum acceptable uncertainty

If measurement uncertainty is equal to or less than maximum acceptable uncertainty the interpretation shall be as given in ETSI EN 303 883 [1], clause 5.7.2.

5.3.2 Measurement uncertainty is greater than maximum acceptable uncertainty

If measurement uncertainty is greater than maximum acceptable uncertainty the interpretation shall be as given in ETSI EN 303 883 [1], clause 5.7.3.

5.4 Emissions

The provisions of ETSI EN 303 883 [1], clause 5.8 shall apply.

6 Conformance test suites

6.1 Introduction

In this clause, the general setup of a test bed for the test of UWB equipment will be described.

A detailed introduction shall be considered as in ETSI EN 303 883 [1], clause 6.1.

6.2 Initial Measurement steps

In initial measurement steps shall be done as described in ETSI EN 303 883 [1], clause 6.2.

6.3 Radiated measurements

6.3.1 General

The provisions of ETSI EN 303 883 [1], clause 6.3.1 shall apply.

6.3.2 Test sites and general arrangements for measurements involving the use of radiated fields

The provisions of ETSI EN 303 883 [1], clause 6.3.2 shall apply.

6.3.3 Guidance on the use of a radiation test site

6.3.3.1 General

The provisions of ETSI EN 303 883 [1], clause 6.3.3 shall apply.

6.3.3.2 Range length.

The provisions of ETSI EN 303 883 [1], clause 6.3.3.5 shall apply.

6.3.4 Coupling of signals

The provisions of ETSI EN 303 883 [1], clause 6.3.4 shall apply.

6.3.5 Standard test methods

6.3.5.1 Generic measurement method

6.3.5.1.1 Calibrated setup

The provisions of ETSI EN 303 883 [1], clause 6.3.5.2 shall apply.

6.3.5.1.2 Substitution method

The provisions of ETSI EN 303 883 [1], clause 6.3.5.3 shall apply.

6.3.6 Standard calibration method

The provisions of ETSI EN 303 883 [1], clause 6.3.6 shall apply.

6.4 Conducted measurements

The provisions of ETSI EN 303 883 [1], clause 6.4 shall apply except as varied herein.

6.5 Conformance methods of measurement for transmitter

6.5.1 General

First the complete signal device shall be measured for:

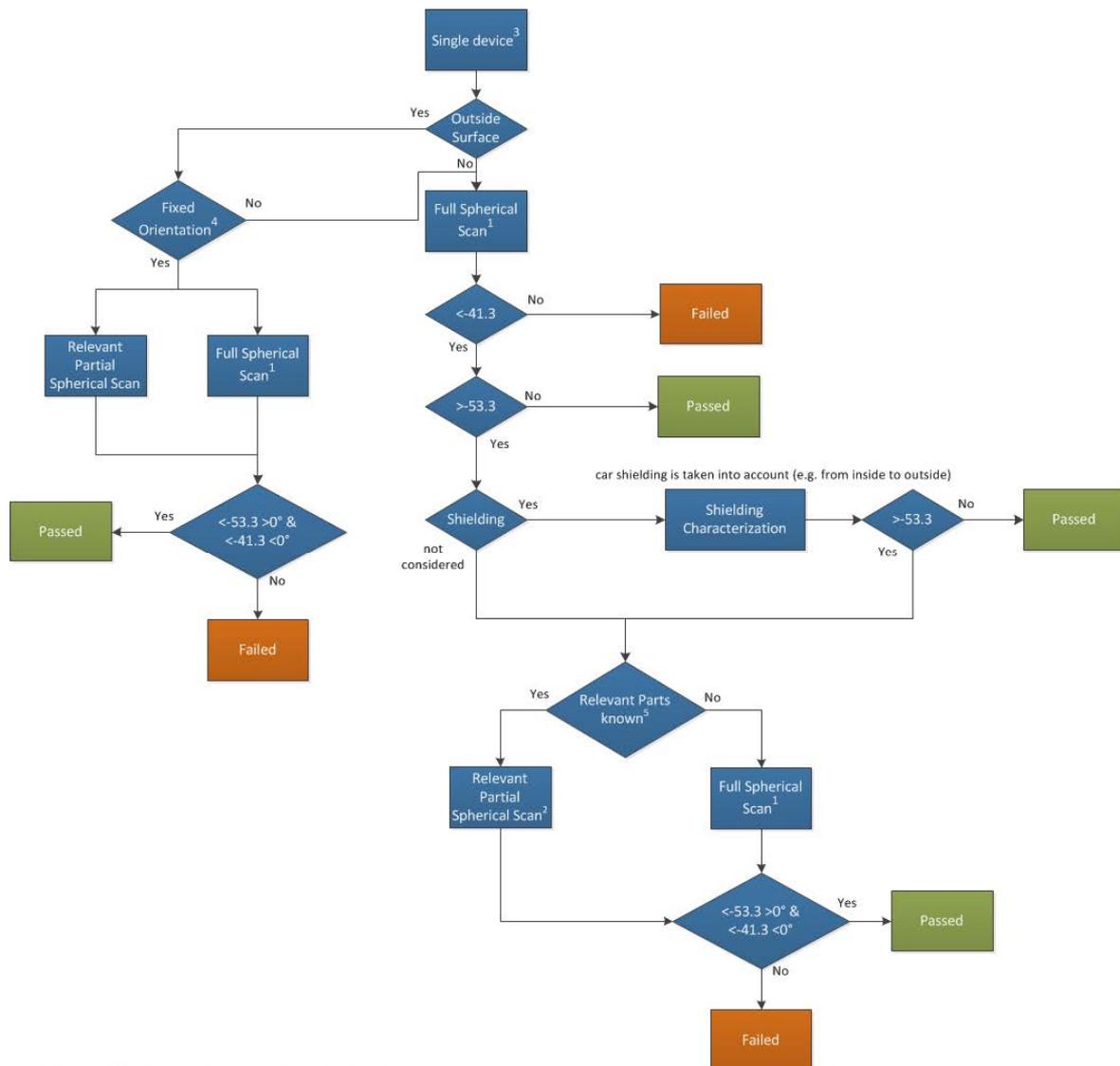
- the maximum mean power spectral density (e.i.r.p.);
- the maximum peak power (e.i.r.p.);
- the operating bandwidth(s);
- the receiver spurious emissions;
- Other emissions (OE);
- Low duty cycle (LDC), when applicable;
- Detect and avoid (DAA), when applicable.

The following methods of measurement shall apply to the testing of stand-alone units and to the equipment configurations identified in clause 5.2.6.

6.5.2 Method of measurements of the Ultra Wideband Emissions

Method of measurements of the Ultra Wideband Emissions shall be as given in ETSI EN 303 883 [1], clause 7.3.

If the DUT implements Exterior Limits, the structure of the measurement procedure under this document shall be as shown in figure 4.



NOTE: All limits are given in e.i.r.p. in dBm/MHz

NOTE 1: Full spherical scan to obtain transmission pattern or common measurement method according to ETSI EN 303 883 [1].

NOTE 2: The horizontal reference plane is the height of the sensor and all measurements have to be performed above 0° elevation to this plane.

NOTE 3: If the part of mounting has influence on the transmission pattern, the manufacturer can declare the whole part as a device, e.g. door, mirror, bonnet, light, etc.

NOTE 4: The fixed orientation on the surface and therefore the main transmission direction can be declared by the manufacturer.

NOTE 5: If there are parts of the vehicle, which have relevant influence on the transmission to the outside, the measurement setup can be reduced to these known relevant parts.

NOTE 6: Proposals for measurement setups and the definition of relevant area/parts are given in ETSI TR 103 086 [i.9].

Figure 4: Concept for the measurement procedure of the exterior limit

The device under test (DUT) is specifically measured for different applications and mounting locations.

If a device has a maximum mean power spectral density (e.i.r.p) of less or equal than -53,3 dBm/MHz including the transmission pattern, then it is only necessary to measure the device by itself. This can be done radiated or conducted according to ETSI EN 303 883 [1]. If the transmission pattern of the device is not known a full spherical scan according to clause 6.3.5.1 and annex B shall be performed.

If the maximum mean power is greater than $-53,3$ dBm/MHz (e.i.r.p.) and no shielding to the outside of the car occurs or the shielding is not considered, then the device has to be measured with the relevant parts of the car, which influence the transmission pattern. When the relevant parts are known, then the device can be measured with these only and if applicable for a relevant area, e.g. see tire applications in annex E. These parts and the relevant area have to be declared by the manufacturer and should be included in the measurement report.

If shielding from the inside to the outside of the car occurs, or other shielding due to the relevant parts occurs, it can be taken into account if the manufacturer can characterize the lowest shielding in all directions to the outside. An example for a measurement procedure for the shielding characterization can be found in ETSI TR 102 070-2 [i.8]. If the transmit power (e.i.r.p.) minus the shielding is less than $-53,3$ dBm/MHz the device passes, otherwise the device shall be measured with the relevant parts of the car.

If the device is mounted outside on the surface of the car and the mounting orientation is known the spherical scan may be reduced to the relevant area, e.g. if the device is mounted on a door the spherical scan can be limited to the area in front of the door (see annex D). The orientation of the device shall be included in the product information (see clause 5.1). If more than one orientation for the transmission is possible, the measurement analysis shall take them into account.

If the dimension of the vehicle, e.g. Truck or Train, is in such dimension that a spherical scan around the DUT cannot be performed, based on the mechanical dimensions of the measurement equipment and the vehicle, the measurement shall be limited to the spherical sector where it can be performed, see figure 5. The test antenna should be at least $0,5$ m away from the surface of the vehicle. If the dimension of vehicle is in such a mechanical dimension that this can also not realized, the vehicle part can be limited to the relevant mechanical parts of the vehicle, see annex D as an example.

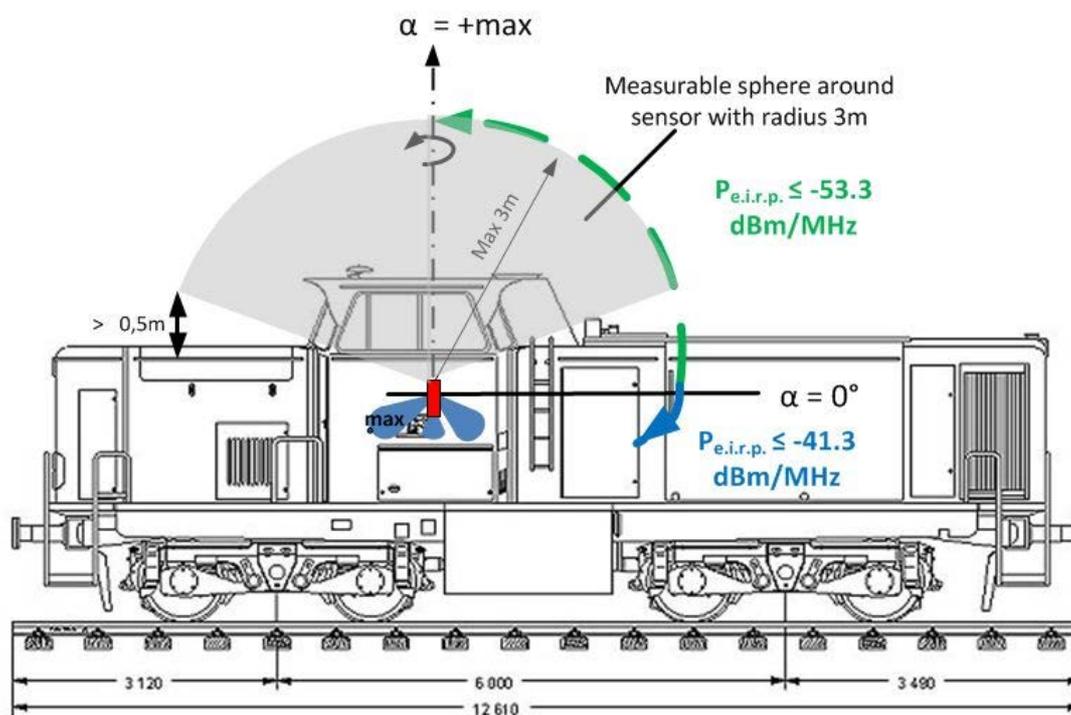


Figure 5: Example for a measurement spherical sector around a huge vehicle

The following methods of measurement shall apply to the testing of stand-alone units and to the equipment configurations identified in clause 5.

6.5.3 Operating Bandwidth

Operating bandwidth measurements shall be performed as given in ETSI EN 303 883 [1], clause 7.4.2.

The results for f_L , f_H , f_M , OBW, and f_C shall be reported in the test report.

6.5.4 Mean power spectral density measurements

Mean power spectral density measurements shall be as given in ETSI EN 303 883 [1], clause 7.4.3.

To classify the Ultra wide band part (clause 4.3.3) and the other emissions (clause 4.3.6) of the radiated emission the initial measurement steps given in ETSI EN 303 883 [1], clause 7.3.2 shall be used.

The measurement method used and the maximum observed value for the mean power spectral density shall be recorded in the test report.

6.5.5 Peak power measurements

To classify the Ultra wide band part (clause 4.3.3) and the other emissions (clause 4.3.6) of the radiated emission the initial measurement steps given in ETSI EN 303 883 [1], clause 7.3.2 shall be used.

The measurement method used and the maximum value for the peak power shall be recorded in the test report.

6.5.6 Exterior limit measurement

To classify the Ultra wide band part (clause 4.3.4) and the other emissions (clause 4.3.6) of the radiated emission the initial measurement steps given in ETSI EN 303 883 [1], clause 7.3.2 and the generic procedure as described in clause 6.5.2, shall be used.

The measurement method used and the maximum observed value for the mean power spectral density shall be recorded in the test report.

6.5.7 Total Power

Not applicable.

6.5.8 Transmitter unwanted emissions

Not applicable.

6.6 Conformance methods of measurement for receiver

6.6.1 Receiver spurious emissions

Receiver spurious emissions measurements shall be as given in ETSI EN 303 883 [1], clause 7.4.5.

The measurement method, level and type (narrowband or wideband) of spurious emissions shall be recorded in the test report.

6.6.2 Receiver interference handling.

Interference signal handling measurements shall be as given in clause 9 of ETSI TS 103 361 [3].

The interferer test frequency range, interferers and interferer power levels, test scenario, performance criterion and level of performance shall be recorded in the test report.

6.7 Conformance test suites for spectrum access

6.7.1 Detect and Avoid (DAA)

Test procedures for DAA mechanisms shall be as given in ETSI EN 303 883 [1], clause 7.4.7.

6.7.2 Listen Before Talk

Not applicable.

6.7.3 Low Duty Cycle

Test Procedures for low duty cycle shall be as given in ETSI EN 303 883 [1], clause 7.4.8.

6.8 Conformance test suites for antenna requirements

Not applicable.

6.9 Other Test Suites

6.9.1 Transmit Power Control

TPC tests to assess the highest and lowest power spectral density level shall be measured using a radiated test procedure, see clause 6.5.4.

6.9.2 Activity Factor

Not applicable.

6.9.3 Frequency Domain Mitigation

Not applicable.

6.9.4 Shielding Effects

Shielding effects may be taken into account when executing transmitter conformance test, as described in clause 6.5.2 or in annex E. The manufacturer shall provide sufficient information on the method adopted for determining the shielding values used in the procedure

6.9.5 Thermal Radiations

Not applicable.

6.9.6 Installation requirements / site registration

Not applicable.

Annex A (normative): 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.13] 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.

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

Harmonised Standard ETSI EN 302 065-3				
The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [i.1]				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	Operating Bandwidth	4.3.1	U	
2	Maximum Value of mean Power Spectral Density	4.3.2	U	
3	Maximum value of peak power	4.3.3	U	
4	Exterior Limit	4.3.4	U	
5	Other Emissions	4.3.6	U	
6	Receiver spurious emissions	4.4.2	C	It applies only when the DUT can work in a receive-only mode or is a receive only device
7	Receiver interference handling	4.4.3	U	
8	Detect and Avoid	4.5.1	C	It applies only to DUT which has implemented this spectrum access mechanism
9	Low Duty Cycle	4.5.3	C	It applies only to DUT which has implemented this spectrum access mechanism
10	Adaptive / Transmit Power Control	4.7.1	C	It applies only to DUT which has implemented this mitigation technique

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.

Clause Number 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 shall be unconditionally applicable (U) or is conditional upon the manufacturers' claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement shall or shall not be 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): Application form for testing

B.1 Introduction

Notwithstanding the provisions of the copyright clause related to the text of the present document, ETSI grants that users of the present document may freely reproduce the application form proforma in this annex so that it can be used for its intended purposes and may further publish the completed application form.

The form contained in this annex may be used by the manufacturer to comply with the requirement contained in clause 4 to provide the necessary information about the equipment to the test laboratory prior to the testing. It contains product information as well as other information which might be required to define which configurations are to be tested, which tests are to be performed as well the test conditions.

This application form should form an integral part of the test report.

B.2 General Information by ETSI EN 302 065-3, clause 5.2.1

B.2.1 Type of Equipment (stand-alone, combined, plug-in radio device, etc.)

- Stand-alone
- Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
- Plug-in radio device (Equipment intended for a variety of host systems)
- Other

B.2.2 The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices

Details provided are for the: stand-alone equipment
 combined (or host) equipment
 test jig

Supply Voltage AC mains State AC voltage V
 DC State DC voltage V

In case of DC, indicate the type of power source

- Internal Power Supply
- External Power Supply or AC/DC adapter
- Battery
- Other:

B.3 Signal related Information by ETSI EN 302 065-3, clause 4.3

B.3.1 Introduction

In accordance with ETSI EN 302 065-3, clause 4.3, the following information is provided by the manufacturer.

B.3.2 Operating bandwidth(s) of the equipment

- Operating Bandwidth 1: MHz to MHz
- Operating Bandwidth 2: MHz to MHz

NOTE: Add more lines if more Frequency Ranges are supported.

B.3.3 The worst case mode for each of the following tests

NOTE: In this section specify the Operational mode and not the measured value. E.g. test mode 1...

- Operating bandwidth(s)
.....
- Mean Power Spectral Density / Peak Power Spectral Density / Exterior Limits / Total Power / Other Emissions / Transmitter unwanted emissions
.....
- Low Duty Cycle
.....

B.4 RX test Information by ETSI EN 302 065-3, clause 4.4

B.4.1 Introduction

In accordance with ETSI EN 302 065-3, clause 4.4, the following information is provided by the manufacturer.

B.4.2 Performance criterion and level of performance

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B 4.3 Interfering signals

Frequency [MHz]	Power [dBm]	Type of signal (e.g. CW, CW with DC, other modulation)

B.5 Information on mitigation techniques by ETSI EN 302 065-3, clauses 4.5 and 4.7

B.5.1 Introduction

In accordance with ETSI EN 302 065-3, clauses 4.5 and 4.7, the following information is provided by the manufacturer.

B.5.2 mitigation techniques

NOTE 1: If there is a specific mode for testing the manufacture have to declare.

NOTE 2: Table with different parameters for different mitigation techniques.

DAA

LDC

a) Frequency range A

Frequency range B

Frequency range C

b) Ton, max

c) Toff, mean

d) \sum Toff in 1 s

e) \sum Ton in 1 h

f) Tdis

TPC

a) Range of power level variation

Annex C (normative): Equivalent mitigation techniques

C.1 Equivalent mitigation techniques and LDC limits

Different mitigation techniques and mitigation factors can be taken into account for the calculation of the maximum allowed TX power of a UWB radio device as long as they reached mitigation factors are equivalent or higher than the mitigation factors reached using the presented techniques which have been accepted by the CEPT/ECC (e.g. CEPT report 45 [i.6]).

EXAMPLE: Deployment of the radio device on a vehicle, which operates only in a restricted indoor area with higher wall attenuation, shielding or the deployment and installation of the UWB system in a controlled manner. The additional mitigation factors need to be weighed against the specific services to be protected and a similar approach has to be taken like e.g. in ECC report 120 [i.3].

The manufacturer shall provide compliance with the transmission emission limits in table 2 (see clause 4.3.2) and table 3 (see clause 4.3.3) when using equivalent mitigation techniques.

NOTE: Regulations in the Commission Decision 2014/702/EC [i.4] allow for other equivalent mitigation techniques to be used across all frequency bands, where these offer at least equivalent protection to that provided by the limits in the decision.

Based on CEPT report 45 [i.6] the combinations of LDC limits and the transmitter emission limits as shown in table 8, may give an equivalent protection as the current baseline LDC limits (see ECC/DEC/(06)04 [i.2], table 6).

C.2 Test Procedure

The manufacturer shall provide sufficient information for determining compliance with the limits given in table C.1.

C.3 Limit

The limits for equivalent LDC mitigation shall be as given in table C.1. These values are defined in CEPT report 45 [i.6].

Table C.1: Limits for low duty cycle to have appropriate mitigation (LDC vs TX Power trading)

mean power spectral density limit (e.i.r.p.) [dBm/MHz]	Maximum transmitter on time % in 1 second	Exterior limit (Elevation > 0°)	T _{on} max [ms]	T _{off} mean [ms]	∑ T _{on} / 1 sec [ms]	min ∑ T _{off} / 1 sec [ms]	Long term LDC [sec in 1 hr, speed ≤ 20 km/h] (figure 3 and note)	Long term LDC [sec in 1 hr, speed ≥ 40 km/h] (figure 3 and note)
-41,3	5	-53,3	5	≥ 38	< 50	> 950	18	180
-44,3	10	-56,3	10	≥ 38	< 100	> 900	36	360
-47,3	20	-59,3	20	≥ 38	< 200	> 800	72	720
-50,3	40	-62,3	40	≥ 38	< 400	> 600	144	1 440
-51,3	50	-63,3	50	≥ 38	< 500	> 500	180	1 800

NOTE: For vehicle speed intermediate between 20 Km/h and 40 Km/h, the long term duty cycle in 1 h (figure 3) shall be computed as linear interpolation of the values in the last two columns.

Annex D (informative): Surface mounted devices example mirror

Figure D.1 shows the measurement flow for the surface mounted devices.

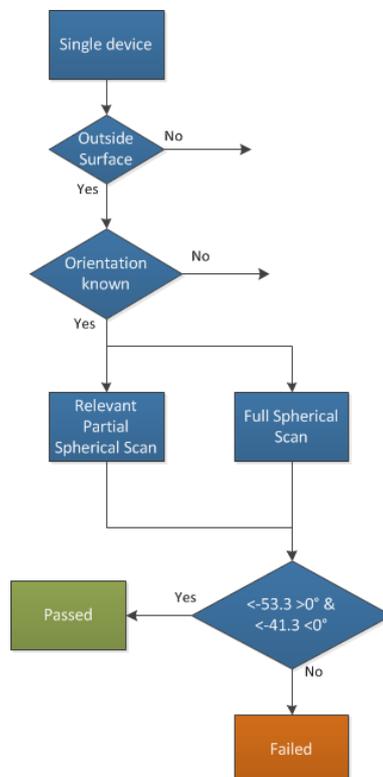


Figure D.1: Measurement Flow

The device inclusive antenna is installed within the mirror, because the mirror influences the transmission pattern of the device.

Usually the orientation of the mirror for the transmission is known and this operating orientation should be included in the product information (see clause 5.1). If the mirror transmits at different positions all positions have to be taken into account.

Usually a mirror does not have complete shielding in one direction a full spherical scan should be performed. If the relevant area can be reduced to a partial sphere, this should be declared by the manufacturer in the test report and only these sphere needs to be measured. An example is if the device is mounted on a door, then the backside of the door is not necessary to measure as the signals are not able to penetrate the metal of the door.

Figure D.2 shows the full spherical scan of the mirror according to clauses 6.5.2 and 6.3.5. In this setup the mirror is rotating and tilting in a way that the full sphere is covered, while the test antenna is fixed. The calibrated or the substituted measurement method should be applied. After all measurements have been taken, the upper and the lower sphere should be analysed (see figure D.3). The reference plane is placed according to the orientation in the application. All e.i.r.p. peaks of the upper sphere should be lower or equal than -53,3 dBm/MHz and all e.i.r.p. peaks below should be smaller or equal to -41,3 dBm/MHz. If this is given the device passes the test otherwise it fails.

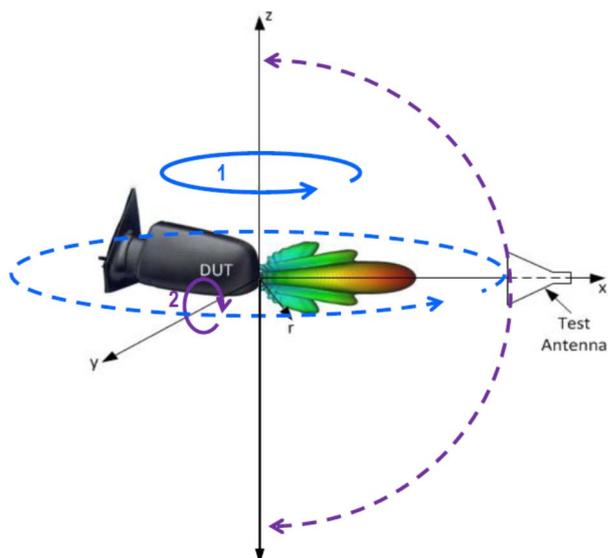


Figure D.2: Full spherical scan of a mirror

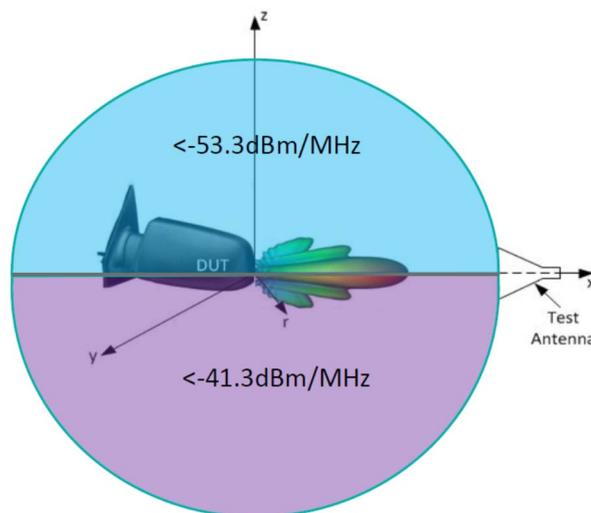


Figure D.3: Analysis of the limits

Annex E (normative): Device mounted inside the tyre

Figure E.1 shows the measurement flow for the device mounted inside the tyre (DUT). The measurement methods are defined in clause 6.3.5. For DUT the horizontal reference plane is the height of the sensor inside the tyre and all measurements have to be performed above 0° elevation with respect to this plane.

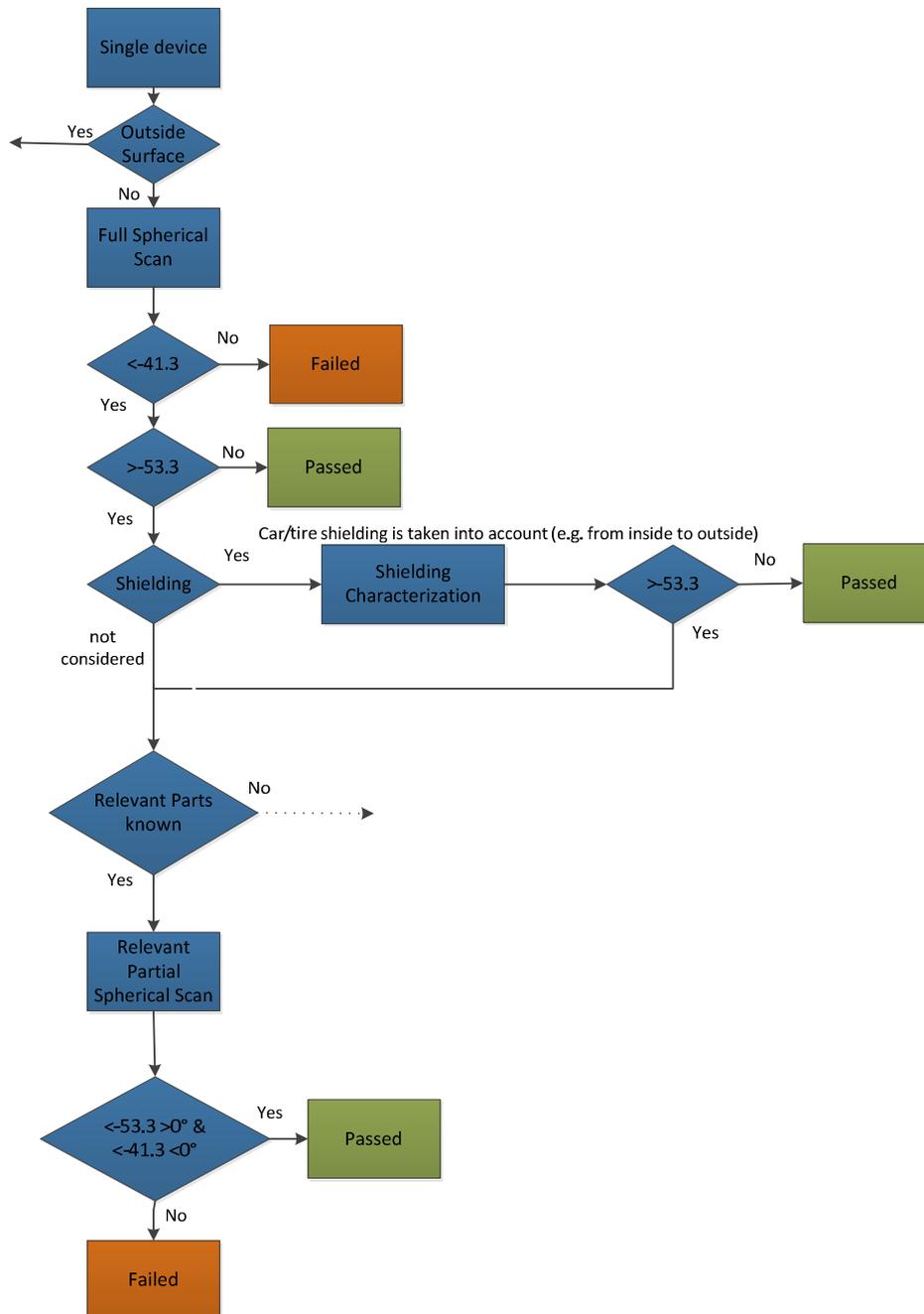


Figure E.1: Measurement Flow (DUT)

The device including the antenna is installed inside the tyre. Although it is mounted outside the metal surface of the vehicle, it cannot be considered outside of its surface. Therefore, the answer to the initial conditional block is negative.

Thus it is necessary to perform a total spherical scan around the device itself. In the case in which the result of the measurement is between -53,3 dBm/MHz and -41,3 dBm/MHz, the shielding characterization of the tyre can be taken into account (clause 6.9.4). The device can be assumed to be compliant if the previously measured PSD level (standalone device) subtracted by the attenuation due to shielding effects of the tyre is smaller than or equal to -53,3 dBm/MHz. The minimum attenuation of the appropriate tyre family as declared by the tyre manufacturer shall be used in the calculation.

NOTE 1: Attenuation due to shielding effects of the tyre is related to the whole wheel including tyre with rim mounted on it.

NOTE 2: A method for the characterization of the attenuation/shielding can be found in annex C of ETSI TR 103 086 [i.9].

If the attenuation due to shielding effects of the tyre is not applicable or sufficient, a partial spherical scan on a realistic ground shall be performed. For the scan the appropriate area in front of the wheel using the representative parts of the vehicle with the equipped tyre shall be used. The limits shall be verified for each 45° of the wheel rotation in the transmission angle.

NOTE 3: A measurement setup with a planar scanner and the definition of relevant area/parts, applicable to this clause, is given in ETSI TR 103 086 [i.9], annex C.

Annex F (informative): Bibliography

- ETSI TS 102 902: "Electromagnetic compatibility and radio spectrum matters (ERM); Methods, parameters and test procedures for cognitive interference mitigation towards ER-GSM for use by UHF RFID using Detect-And-Avoid (DAA) or other similar techniques".
- Commission Decision 2007/131/EC of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (notified under document number C(2007) 522).
- Commission Decision 2009/343/EC of 21 April 2009 amending Decision 2007/131/EC on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (notified under document number C(2009) 2787).

Annex F (informative): Change history

Date	Version	Information about changes
April 2014	1.1.1	Last publication as HS under R&TTE
July 2016	2.1.1	<ul style="list-style-type: none"> • Revision for compliance with Directive 2014/53/EU • 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" <ul style="list-style-type: none"> • New Annex C "Equivalent mitigation techniques" • New Annex D "Surface mounted devices example mirror" • New Annex E "Device mounted inside the tyre"

History

Document history		
V1.1.1	April 2014	Publication
V2.1.0	April 2016	EN Approval Procedure AP 20160717: 2016-04-18 to 2016-07-18
V2.1.1	November 2016	Publication