



**Short Range Devices (SRD) using
Ultra Wide Band technology (UWB);
Harmonised Standard covering the essential requirements of
article 3.2 of Directive 2014/53/EU;
Part 5: Devices using UWB technology onboard aircraft**

Reference

DEN/ERM-TGUWB-142

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.5] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.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 5 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.6].

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document applies to transceivers, transmitters and receivers utilizing Ultra WideBand (UWB) technologies and used onboard aircraft, i.e. radio links for intra-aircraft communications purposes inside an aircraft.

The present document applies to impulse, modified impulse and RF carrier based UWB communication technologies.

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(12)03 [i.2] "*The harmonised conditions for UWB applications onboard aircraft*".

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

Table 1: Permitted ranges of operation [i.2]

Permitted range of operation (see note 1)	
Transmit	30 MHz to 10,6 GHz
Receive	30 MHz to 10,6 GHz
Intended ranges of operation (preferred range of operating bandwidth), see note 2	
Transmit	6,0 GHz to 6,650 GHz
Receive	6,0 GHz to 6,650 GHz
Transmit	6,6752 GHz to 8,5 GHz
Receive	6,6752 GHz to 8,5 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.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://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 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.

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

- [i.1] 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(12)03 of 2 November 2012: "The harmonised conditions for UWB applications onboard aircraft".
- [i.3] 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.4] CEPT/ERC Recommendation 74-01: "Unwanted emissions in the spurious domain".
- [i.5] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.
- [i.6] 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.7] ECC REP 175: "Co-existence study considering UWB applications inside aircraft and existing radio services in the frequency bands from 3.1 GHz to 4.8 GHz and from 6.0 GHz to 8.5 GHz".
- [i.8] ECC REP 93: "Compatibility between GSM equipment on board aircraft and terrestrial networks. Revised ECC Report with Annex G" (May 2008).
- [i.9] ETSI TR 103 181-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB);Transmission characteristics Part 2: UWB mitigation techniques".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

altitude: height of the aircraft above the ground

narrowband: equipment to be used in a non-channelized continuous frequency band with an occupied bandwidth of equal or less than 25 kHz, or equipment to be used in a channelized frequency band with a channel spacing of equal or less than 25 kHz

onboard aircraft: use of radio links for intra-aircraft communications purposes inside an aircraft

3.2 Symbols

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

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
MSL	Mean Sea Level

NF	Noise Figure
TR	Technical Report
TS	Technical Specification

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 dBc 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 one 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 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 to 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 tests of any 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 of the present document.

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.) [i.3]

Frequency range [GHz]	Maximum mean e.i.r.p. spectral density without mitigation techniques	Maximum mean e.i.r.p. spectral density with mitigation techniques	Requirements for mitigation techniques
$f \leq 1,6$ GHz	-90 dBm/MHz	-90 dBm/MHz	
1,6 GHz < $f \leq 2,7$ GHz	-85 dBm/MHz	-85 dBm/MHz	
2,7 GHz < $f \leq 3,4$ GHz	-70 dBm/MHz	-70 dBm/MHz	
3,4 GHz < $f \leq 3,8$ GHz	-80 dBm/MHz	-80 dBm/MHz	
3,8 GHz < $f \leq 6$ GHz	-70 dBm/MHz	-70 dBm/MHz	
6,0 GHz < $f \leq 6,650$ GHz	-41,3 dBm/MHz	-41,3 dBm/MHz	
6,650 GHz < $f \leq 6,6752$ GHz	-62,3 dBm/MHz	-41,3 dBm/MHz	A notch of 21 dB to be implemented to meet a level -62,3 dBm/MHz (see note 1)
6,6752 GHz < $f \leq 7,25$ GHz	-41,3 dBm/MHz	-41,3 dBm/MHz	
7,25 GHz < $f \leq 7,75$ GHz	$-51,3 - 20 * \log_{10}(10 \text{ [km]} / x \text{ [km]})$ dBm/MHz	-41,3 dBm/MHz	7,25 - 7,75 GHz (FSS and MetSat (7,45 - 7,55 GHz) protection) see notes 1 and 2
7,75 GHz < $f \leq 7,9$ GHz	$-44,3 - 20 * \log_{10}(10 \text{ [km]} / x \text{ [km]})$ dBm/MHz	-41,3 dBm/MHz	7,75 - 7,9 GHz (MetSat protection) see notes 1 and 2
7,9 GHz < $f \leq 8,5$ GHz	-41,3 dBm/MHz	-41,3 dBm/MHz	
8,5 GHz < $f \leq 10,6$ GHz	-65 dBm/MHz	-65 dBm/MHz	
10,6 GHz < f	-85 dBm/MHz	-85 dBm/MHz	

NOTE 1: Alternative mitigation techniques offering equivalent protection such as the use of shielded portholes are permitted, provided the attenuation as tested in annex C reduces the e.i.r.p. outside the aircraft to the limits equal to those defined in the column without mitigation techniques is at least equal to the attenuation required to obtain e.i.r.p. equal to those without mitigation techniques.

NOTE 2: Without mitigation techniques, the altitude related transmit power control from clause 4.7.1 shall be implemented.

NOTE 3: 'x' is the height of the aircraft above the ground.

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 of 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 [i.3]

Frequency range [GHz]	Maximum peak e.i.r.p. (defined in 50 MHz) without mitigation techniques	Maximum peak e.i.r.p. (defined in 50 MHz) with mitigation techniques	Requirements for mitigation techniques
$f \leq 1,6$ GHz	-50 dBm	-50 dBm	
1,6 GHz < $f \leq 2,7$ GHz	-45 dBm	-45 dBm	
2,7 GHz < $f \leq 3,4$ GHz	-36 dBm	-36 dBm	
3,4 GHz < $f \leq 3,8$ GHz	-40 dBm	-40 dBm	
3,8 GHz < $f \leq 6$ GHz	-30 dBm	-30 dBm	
6,0 GHz < $f \leq 6,650$ GHz	0 dBm	0 dBm	
6,650 GHz < $f \leq 6,6752$ GHz	-21 dBm	-21 dBm	A notch of 21 dB to be implemented to meet a level -62,3 dBm/MHz (see note)
6,6752 GHz < $f \leq 8,5$ GHz	0 dBm	0 dBm	
8,5 GHz < $f \leq 10,6$ GHz	-25 dBm	-25 dBm	
10,6 GHz < f	-45 dBm	-45 dBm	

NOTE: Alternative mitigation techniques offering equivalent protection such as the use of shielded portholes are permitted, provided the attenuation as tested in annex C is at least 21 dB.

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

This requirement does not apply to any DUT.

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 4.

Table 4: Other Emission limits (radiated)

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 permitted range of frequencies.	

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

For a detailed description of related UWB receiver requirements see ETSI TS 103 361 [2].

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 5 in the indicated bands (see CEPT/ERC/REC 74-01 [i.4]).

Table 5: Narrowband spurious emission limits for receivers

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 6.

Table 6: Wideband spurious emission limits for receivers

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. For common applications, recommended performance criteria and test cases are defined in clause 9.4 of ETSI TS 103 361 [2]. For other applications, the manufacturer shall choose an appropriate performance criterion according to clause 9.2.1 of ETSI TS 103 361 [2]. The performance criterion shall be stated in the user manual (see clause 9.2.2 of ETSI TS 103 361 [2]).

4.4.3.3 Limits

The level of performance of the chosen performance criterion shall meet the minimum requirement defined in clause 9 of ETSI TS 103 361 [2].

4.4.3.4 Conformance

The conformance test suite for receiver interference 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

These requirements do not apply to any DUT.

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 applies to all transmitting DUT that make use of the limits without mitigation techniques in table 2 in the frequency range between 7,25 GHz and 7,9 GHz.

4.7.1.2 Description

Adaptive or 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

The limits depend on the frequency range and the altitude of the aircraft and shall be as listed in table 7.

Table 7: Limits for altitude related transmit power control

Aircraft altitude	7,25 GHz < f ≤ 7,75 GHz	7,75 GHz < f ≤ 7,9 GHz
x ≤ 1 km	-71,3 dBm/MHz	-64,3 dBm/MHz
1 km < x	min(-51,3 - 20 * log ₁₀ (10 [km] / x [km]), -41,3) dBm/MHz	Min(-44,3 - 20 * log ₁₀ (10 [km] / x [km]), -41,3) dBm/MHz

4.7.1.4 Conformance

The conformance tests for Adaptive/Transmit Power Control 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

This requirement does not apply to any DUT.

4.7.3 Frequency Domain Mitigation

This requirement does not apply to any DUT.

4.7.4 Shielding Effects

This requirement does not apply to any DUT.

4.7.5 Thermal Radiation

This requirement does not apply to any DUT.

4.7.6 Site Registration

This requirement does not apply to any DUT.

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 requirements for the test modulation shall be as given in ETSI EN 303 883 [1], clause 5.3.

5.2.3 Test conditions, power supply and ambient temperatures

The test conditions, power supply and ambient temperatures shall be as given in ETSI EN 303 883 [1], clause 5.4.

5.2.4 Choice of equipment for test suites

The choice of the equipment for the test suites shall be as given in ETSI EN 303 883 [1], clause 5.5.

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 4.2). 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

Testing of host connected equipment and plug-in radio devices measurements shall be as given in ETSI EN 303 883 [1], clause 5.6.

5.3 Interpretation of the measurement results

5.3.1 General

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

5.3.2 Measurement uncertainty is equal to or lower 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.

5.3.3 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.

5.3.4 Emissions

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

6 Conformance test suits

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

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

6.4.1 General Setup

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

6.4.2 Specific Setup

This requirement does not apply to any DUT.

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).

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.

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 4.3.2) 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

Peak power measurements shall be as given in ETSI EN 303 883 [1], clause 7.4.4.

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

Not applicable.

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 [2].

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

Not applicable.

6.8 Conformance test suites for antenna requirements

Not applicable.

6.9 Other Test Suites

6.9.1 Transmit Power Control

Transmit power control measurements shall be performed as given in ETSI EN 303 883 [1], clause 7.4.6.

The manufacturer shall supply the test house with a method to emulate different altitudes into the DUT.

Transmit power control shall be tested at the equivalent of MSL, 1 km, 2km altitude and the maximum altitude of the aircraft.

6.9.2 Activity Factor

Not applicable.

6.9.3 Frequency Domain Mitigation

Not applicable.

6.9.4 Shielding Effects

Not applicable.

6.9.5 Thermal Radiations

Not applicable.

6.9.6 Installation requirements/site registration

Not applicable.

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.5] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.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 302 065-5				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	Operating bandwidth	4.3.1	C	All transmitting devices
2	Maximum value of mean power spectral density	4.3.2	C	All transmitting devices
3	Maximum value of peak power	4.3.3	C	All transmitting devices
4	Other emissions	4.3.6	C	All transmitting devices
5	Receiver spurious emissions	4.4.2	C	Applies only to equipment that can be operated in a receive-only mode
6	Receiver interference handling	4.4.3	C	All receiving devices
7	Transmit power control	4.7.1	C	Applies to all transmitting DUTs that make use of the limits without mitigation techniques in table 2

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 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): 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 Product Information for ETSI EN 302 065-5, 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 for ETSI EN 302 065-5, clause 4.3

B.3.1 Introduction

In accordance with ETSI EN 302 065-5, 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, etc.

- Operating bandwidth(s)
.....
- Mean Power Spectral Density/Peak Power Spectral Density/Other Emissions
.....

B.4 RX test Information for ETSI EN 302 065-5, clause 4.4

B.4.1 Introduction

In accordance with ETSI EN 302 065-5, clause 4.4, the following information is provided by the manufacturer.

B.4.2 Performance criterion and level of performance

- Performance criterion (e.g. accuracy, sensitivity)
.....
- Level of performance (e.g. for accuracy $\pm 10\%$, level of sensitivity)
.....

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 as required by ETSI EN 302 065-5, clause 4.7

B.5.1 Mitigation techniques

The manufacturer declare the inclusion and any necessary implementation details of any mitigation or equivalent mitigation techniques. See also ETSI TR 103 181-2 [i.9].

APC/TPC

Range of power level variation:.....

Activity factor and duty cycle

Specify.....

Frequency domain mitigation

Specify.....

Shielding effects

Specify.....

Site registration

Specify.....

Equivalent mitigation techniques

Specify.....

Others

Specify.....

B.6 Additional information provided by the applicant

B.6.1 About the DUT

The equipment submitted are representative production models.

If not, the equipment submitted are pre-production models?

If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested.

If not, supply full details:

.....

.....

B.6.2 Additional items and/or supporting equipment provided

Spare batteries (e.g. for portable equipment).

Battery charging device.

- External Power Supply or AC/DC adapter.
- Test Jig or interface box.
- RF test fixture (for equipment with integrated antennas).
- Host System Manufacturer:
- Model #:
- Model name:
- Combined equipment Manufacturer:
- Model #:
- Model name:
- User Manual.
- Technical documentation (Handbook and circuit diagrams)

Annex C (normative): Procedure for measurement of the porthole attenuation

The measurement principle is shown in figures C.1 and C.2. In a first step, calibration is performed using the setup shown in figure C.1.

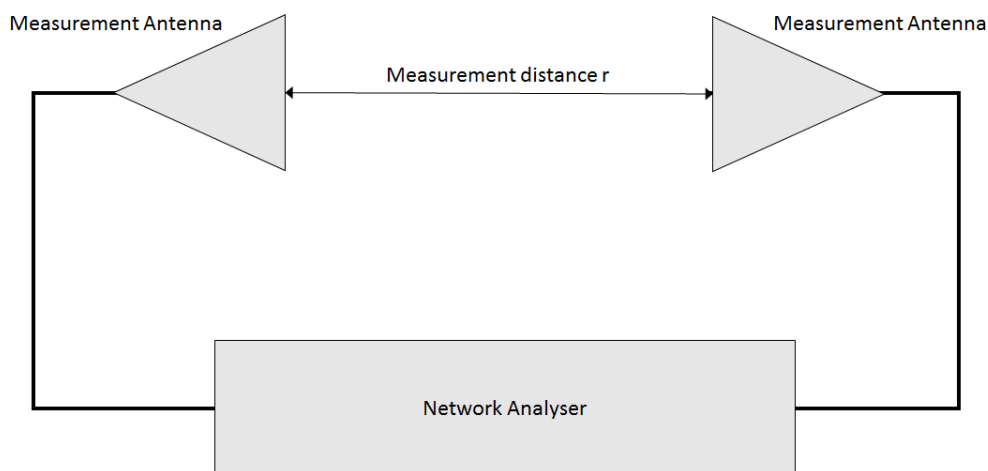


Figure C.1: Calibration setup

It is important that both antennae are aligned to each other exactly and the distance between the two identical antennae shall be larger than $2 \times$ minimal far field distance.

The antenna beamwidth of the measurement antennas shall be lower than:

$$\frac{ant_beam(f)}{2} < \arctan\left(\frac{size_of_the_fuselage}{r}\right)$$

Calibration Steps:

- 1) Set the network analyser to the minimum and maximum frequency range (960 MHz to 10,6 GHz). The frequency range depends on the measurement antennas.
- 2) Calibrate the system in the S21 Mode.

In the second step the porthole attenuation measurement is performed. After calibration of the setup, the porthole shall be placed between the two antennas.

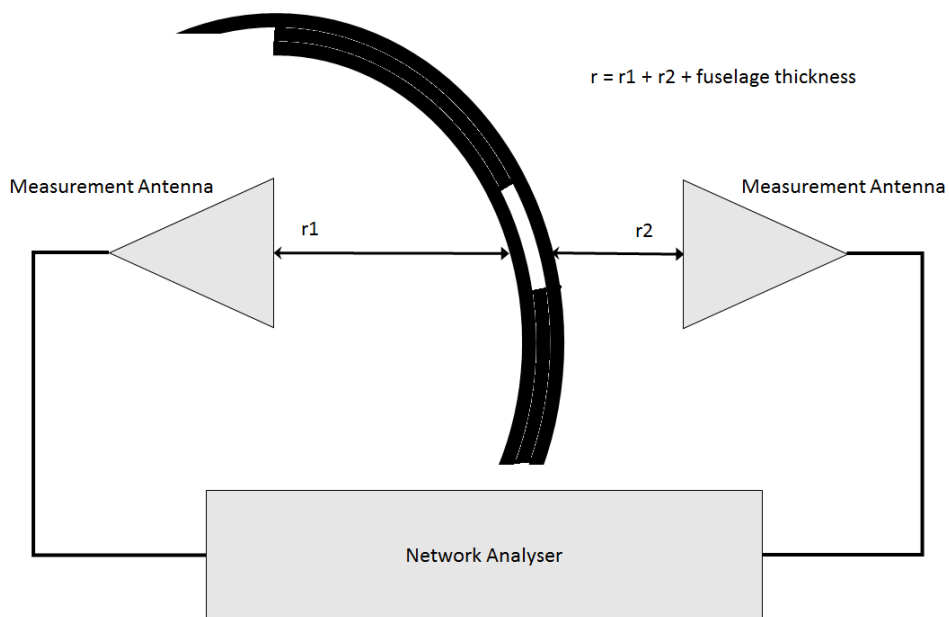


Figure C.2: Attenuation measurement

The network analyser shall then be used with the time gating option. This is important because with this option it is possible to obtain the necessary signal parts for the attenuation measurement (more signal components or more signal reflexions can yield to wrong results).

Other setups can be used if the presented method in this clause is not feasible [i.7] and [i.8].

Annex D (informative): Measurement antenna, preamplifier, and cable specifications

The radiated measurements set-up in annex B of ETSI EN 303 883 [1] specifies the use of a horn antenna and a wide-band high gain preamplifier above 1 GHz in order to measure the very low radiated power density level from UWB equipment.

Table D.1 gives examples of recommended data and features for the horn antenna and preamplifier to be used for the test set-up.

Table D.1: Recommended Hardware

Device	Parameter	Value
Preamplifier LNA	Bandwidth	< 1 GHz to > 15 GHz
	NF	< 2,5 dB
	Gain	> 30 dB
	Gain flatness across band	±1,5 dB
	VSWR in/out across band	< 2:1
	Nominal impedance	50 Ω
RX Horn Antenna	3 dB bandwidth	< 1 GHz to > 15 GHz
	VSWR across band	< 1,5:1
	Gain (10 GHz)	> 16 dBi
	Gain (8 GHz)	> 14 dBi
	Gain (6 GHz)	> 12,5 dBi
	Gain (2 GHz - 5 GHz)	> 10 dBi
Cable	Nominal impedance	50 Ω
	VSWR	< 1,2:1
	Shielding	> 60 dB
	Losses	Take losses into account for total gain calculations
NOTE:	The noise floor of the combined equipment should be at least 6 dB below the specified limits, but 10 dB would be optimal.	

History

Document history			
V1.1.0	March 2017	EN Approval Procedure	AP 20170620: 2017-03-22 to 2017-06-20