



**Short Range Devices (SRD)
and Ultra Wide Band (UWB);
Part 1: Measurement techniques
for transmitter requirements**

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ETSI

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

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

Siret N° 348 623 562 00017 - APE 7112B
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Foreword

This draft 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 EN Approval Procedure.

The present document is part 1 of a multi-part deliverable covering Short Range Devices (SRD) and Ultra Wide Band (UWB), as identified below:

Part 1: "Measurement techniques for transmitter requirements";

Part 2: "Measurement techniques for receiver requirements".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
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Introduction

Ultra Wide Band (UWB) radio technology enables a new generation of high-speed data devices for short-range communication purposes as well as location tracking and Sensor devices and opens new markets with a variety of innovative applications.

UWB devices may form an integral part of other portable electronic equipment such as future generation cellular phones or laptops equipped with UWB enabled short-range air interfaces.

In addition, UWB devices with an operating frequency range of several hundreds of MHz up to several GHz allow tens of centimetre-level accuracy real time localization and positioning even in the presence of severe multipath effects caused by walls, furniture or any other harsh radio propagation environments.

Based on the broad variety of different applications and the broad possible frequency range of operation the number of possible deployed physical signal formats can be very large. The existing range of physical signal and modulation formats range from traditional carrier based systems like OFDM over spread spectrum based system to carrier less systems based on base band pulses. The frequency regulation on the other side only defines a single set of transmission limits and values, which have to be fulfilled by all systems under the UWB regulation. Furthermore, the very high channel bandwidth of a UWB signal gives a specific challenge to the needed measurement setup and the procedures. Existing measurement procedures need to be extended and new possible techniques should be described in the present document.

The present document is structured as follows:

- Clauses 1 through 3 provide a general description on the types of equipment covered by the present document and the definition of terms, symbols and abbreviations used.
- Clause 4 provides an overview on the technical and technology basics which were considered during the preparation of the present document.
- Clause 5 specifies EUT TX requirements and the related conformance procedure.
- Annex A provides information on test conditions, used test sites and procedures.
- Annex B provides necessary information on radiated test procedures.
- Annex C provides information on TX signal types.
- Annex D provides information on the all emission concept.
- Annex E provides information for a pre-scan radiated power measurement test procedure.
- Annex F provides information on differences between the different emission power measurements.
- Annex G provides information on Out-of-band and spurious requirements for EUT covered by ECC/DEC(22)03 [i.40].
- Annex H provides information what specifications, parameters, need to be considered in the related standard.
- Annex I provides a change history table containing the major technical changes.

1 Scope

The present document summarizes the available information of possible measurement techniques and procedures for the conformance measurement of various signal formats (e.g. Ultra Wide Band (UWB)) in order to comply with the given transmission limits given in the current regulation.

The present document could be used as a reference for existing and future ETSI standards covering UWB and other technologies.

2 References

2.1 Normative references

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

- [1] [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".
- [2] [ETSI TS 102 321 \(V1.1.1\)](#): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Normalized Site Attenuation (NSA) and validation of a fully lined anechoic chamber up to 40 GHz".
- [3] [ETSI TS 103 941 \(V.1.1.1\)](#): "Ultra Wide Band (ERM); Radiated tests for UWB technology-based devices under extreme environmental conditions".

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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] ETSI TS 103 060 (V1.1.1) (09-2013): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Method for a harmonized definition of Duty Cycle Template (DCT) transmission as a passive mitigation technique used by short range devices and related conformance test methods".
- [i.2] [ITU Radio Regulations](#).
- [i.3] [ECC/DEC\(06\)04](#): "The harmonised conditions for devices using UWB technology in bands below 10.6 GHz", 24 March 2006, amended 9 December 2011 and amended 8 March 2019.

- [i.4] [ECC/DEC\(07\)01](#): "The harmonised use, exemption from individual licensing and free circulation of Material Sensing Devices using Ultra-Wideband (UWB) technology", 30 March 2007, amended on 26 June 2009, corrected on 18 November 2016 and amended on 8 March 2019.
- [i.5] [Commission Implementing Decision \(EU\) 2019/785 of 14 May 2019](#) on the harmonisation of radio spectrum for equipment using ultra-wideband technology in the Union and repealing Decision 2007/131/EC (notified under document C(2019) 3461).
- [i.6] [ECC/DEC\(11\)02](#): "Industrial Level Probing Radars (LPR) operating in frequency bands 6-8.5 GHz, 24.05-26.5 GHz, 57-64 GHz and 75-85 GHz", 11 March 2011, updated on 17 November 2017 and amended on 5 July 2019.
- [i.7] [ERC Recommendation 70-03](#): "Relating to the use of Short Range Devices (SRD)".
- [i.8] [Commission Implementing Decision \(EU\) 2019/1345 of 2 August 2019](#) amending Decision 2006/771/EC updating harmonised technical conditions in the area of radio spectrum use for short-range devices (notified under document C(2019) 5660).
- [i.9] [ERC Recommendation 74-01](#): "Unwanted Emissions in the spurious domain", latest amendment on 29 May 2019".
- [i.10] Recommendation ITU-R SM.329-12 (09/2012): "Unwanted emissions in the spurious domain".
- [i.11] [ECC/DEC\(06\)08](#): "The conditions for use of the radio spectrum by Ground- and Wall- Probing Radar (GPR/WPR) imaging systems", December 2016, updated on 26 October 2018.
- [i.12] ETSI EN 302 372 (V2.1.1) (12-2016): "Short Range Devices (SRD); Tank Level Probing Radar (TLPR) equipment operating in the frequency ranges 4,5 GHz to 7 GHz, 8,5 GHz to 10,6 GHz, 24,05 GHz to 27 GHz, 57 GHz to 64 GHz, 75 GHz to 85 GHz; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.13] [ECC/DEC\(04\)03](#): "The frequency band 77-81 GHz to be designated for the use of Automotive Short Range Radars" 19 March 2004.
- [i.14] ETSI TR 103 181-2 (V1.1.1) (06-2014): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB);Transmission characteristics Part 2: UWB mitigation techniques".
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3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

All Emissions (AE): related UWB Emission of the transmitter (RP), Transmitter Unwanted Emissions (TXUE) and Other Emissions (OE) of the EUT

NOTE: See emission concept in clause 5.1.2.1.

antenna cycle: one complete sweep of a mechanically or electronically scanned antenna beam along a predefined spatial path

antenna port (or antenna connector): physical port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy. The connector is typically a standardized coaxial or a hollow waveguide connector.

antenna positioner: mechanical structure to place and move the measurement/test antenna in the test set-up

NOTE For example a mechanical arm (see figure B.13 and figure B.14) or measurement tower (see figure B.12) or curved runner to adjust measurement/test antenna along a adjusted azimuth angle Φ (at the adjusted measurement distance) and the possibility to move the test/measurement antenna along the polar angle θ from $0^\circ \leq \theta \leq 90^\circ$. Positioners are typically consisting on material which create low reflections or are coated with radio absorbing material (absorbers).

antenna scan duty factor: ratio of the solid angle of the antenna beam (measured at its 3 dB point) to the total solid angle scanned by the antenna

associated antenna: antenna and all its associated components which are designed as an indispensable part of the equipment

avoidance level: maximum amplitude to which the UWB transmit power is set for the relevant protection zone

burst: emitted signal whose time duration (T_{on}) is not related to its bandwidth

co-located receiver: receiver is located in the same device housing as the transmitter

combined equipment: any combination of non-radio equipment and a plug-in radio device that would not offer full functionality without the radio device

dedicated antenna: specified antenna which is part of the EUT

NOTE: For example, a removable antenna supplied and tested with the radio equipment, designed as an indispensable part of the equipment. It is a specified external antenna by the manufacturer (within the EUT manual) to operate as intended with the rest of the EUT.

default avoidance bandwidth: portion of the victim service bandwidth to be protected if no enhanced service bandwidth identification mechanisms are implemented in the DAA enabled devices

detect and avoid time: time duration between a change of the external RF environmental conditions and adaptation of the corresponding UWB operational parameters

duty cycle: ratio, expressed as a percentage, of $\Sigma(T_{\text{on}})/(T_{\text{obs}})$ where T_{on} is the "on" time of a single transmitter device and T_{obs} is the observation period, see ETSI TS 103 060 [i.1]

Effective Radiated Power (E.R.P): product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction (RR 1.162)

equivalent isotropically radiated power (e.i.r.p.): product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain)

NOTE: See ITU Radio Regulations [i.2], RR 1.161.

far field measurement: measurement at a distance from an antenna sufficient to ensure that the electro-magnetic field approximates a plane wave (see clause B.2.1)

frequency span: frequency range between the start and stop frequency of the RP measurement set-up

gating: transmission that is intermittent or of a low duty cycle referring to the use of burst transmissions where a transmitter is switched on and off for selected time intervals

Half Power Beam Width (or Beamwidth): angular separation, in which the magnitude of the radiation pattern decreases by 50 % (or - 3dB) from the peak of the main beam

hopping: spread spectrum technique whereby individual radio links are continually switched from one subchannel to another

hopping cycle: number of hopping positions for a full frequency hopping sequence

host equipment: any equipment which has complete user functionality when not connected to the radio equipment part and to which the radio equipment part provides additional functionality and to which connection is necessary for the radio equipment part to offer functionality

impulse: pulse whose width is determined by its step risetimes and whose maximum amplitude is determined by its step value (see clause 5.10)

indirect emissions: emissions radiated in all directions in a specified scenario (see clause 5.7, including direct emissions from the housing/structure of the equipment and emissions reflected or passing through a media under inspection or through a scenario)

NOTE: These emissions are sometimes also named an exterior limit or unwanted emissions.

integral antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment

main beam direction (or mainbeam): direction of maximum gain of a directional antenna

NOTE: EUT may have different main beam direction for TX and RX antennas.

mean power: power during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation envelope

measurement antenna: antenna to measure the emission radiated from the EUT, see clause B.2.2.5

measurement cycle: whole-numbered multiple of signal repetition time

minimum avoidance bandwidth: portion of the victim service bandwidth requiring protection

minimum initial channel availability check time: minimum time the UWB radio device spends searching for victim signals after power on, Parameter: $T_{\text{avail, Time}}$

Non-Interference Mode operation (NIM): operational mode that allows the use of the radio spectrum on a non-interference basis without active mitigation techniques