Draft ETSI EN 305 550-6 V1.1.0 (2024-10)

Short Range Devices (SRD) to be used in the 40 GHz to 260 GHz frequency range; Harmonised Standard for access to radio spectrum; Part 6: Specific radiodetermination applications - Tank Level Probing Radar (TLPR) and Level Probing Radar (LPR) equipment operating in the frequency ranges 116 GHz to 148,5 GHz; 167 GHz to 182 GHz and 231,5 GHz to 250 GHz

Reference
DEN/ERM-TGUWB-627

Keywords
harmonised standard, measurement, radar, sensor, SRD

ETSI

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

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

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

Important notice

The present document can be downloaded from the ETSI Search & Browse Standards application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on ETSI deliver.

Users should be aware that the present document may be revised or have its status changed, this information is available in the Milestones listing.

If you find errors in the present document, please send your comments to the relevant service listed under Committee Support Staff.

If you find a security vulnerability in the present document, please report it through our Coordinated Vulnerability Disclosure (CVD) program.

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.
No recommendation as to products and services or vendors is made or should be implied.
In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

Contents

Intellectual Property Rights

Essential patents

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

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

Trademarks

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

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

Foreword

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

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

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

The present document is part 6 of a multi-part deliverable covering Short Range Devices (SRD) to be used in the 40 GHz to 260 GHz frequency range; Harmonised standard for access to radio spectrum, as identified below:

Part 1: "Communication devices within 57 GHz to 64 GHz, 122 GHz to 123 GHz or 244 GHz to 246 GHz";

Part 2: "Radiodetermination for industrial applications (RDI & RDI-S) equipment operating within 116 GHz to 260 GHz";

Part 3: "Radiodetermination for consumer applications within 57 GHz to 64 GHz, 122 GHz to 130 GHz, 134 GHz to 148,5 GHz or 244 GHz to 246 GHz";

Part 4: "Radiodetermination devices at vehicles within 57 GHz to 64 GHz";

Part 5: "Ultra Short Range Communication Device (USRCD) within 57 GHz to 64 GHz";

Part 6: "Specific radiodetermination applications - Tank Level Probing Radar (TLPR) and Level Probing Radar (LPR) equipment operating in the frequency ranges 116 GHz to 148,5 GHz; 167 GHz to 182 GHz and 231,5 GHz to 250 GHz".

NOTE: The list above shows the planned multi-part deliverable, at the time, when the present document was finalized.

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

Modal verbs terminology

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

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

ETSI ERM TGUWB decided to develop more specific standards; this means instead of one generic ETSI EN 305 550 for generic SRD within 40 GHz to 260 GHz, a standard family was started to reflect the intended use in relation to the wanted technical performances in more detail.

The present document is the first version of the harmonised standard ETSI EN 305 550-6 for Level Probing Radar (LPR) and Tank Level Probing Radar (TLPR) equipment using UWB technology in the frequency ranges 116 GHz to 148,5 GHz, 167 GHz to 182 GHz and 231,5 GHz to 250 GHz, and it is part of the standard family ETSI EN 305 550-x which covers Short Range Devices (SRD) to be used in the 40 GHz to 260 GHz frequency range in general.

1 Scope

The present document specifies technical requirements, limits and test methods for SRD radiodetermination equipment using Ultra Wide Band technology (UWB) in the frequency ranges from 116 GHz to 148,5 GHz, from 167 GHz to 182 GHz, and from 231,5 GHz to 250 GHz for Level Probing Radar (LPR) and Tank Level Probing Radar (TLPR).

Level Probing Radars and Tank Level Probing Radars consist of a combined transmitter and receiver and are equipped with an integral or dedicated antenna provided also by the EUT manufacturer. EUTs intended to be equipped with antennas from third-party manufacturers are not covered by the scope of the present document.

Furthermore, the present document is limited to LPR and TLPR devices with FMCW modulation (see clause C.2.2 of ETSI EN 303 883-1 [1]).

Further details of the covered LPR and TLPR EUT can be found in clause 4.2 of the present document.

NOTE 1: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] is given in annex A.

NOTE 2: Equipment covered by the present document operates in accordance with clause 2.3 and clause 2.5 of ECC Decision(22)03 [i.3] and the upcoming EC framework for UWB/SRDs for the range 116 GHz to 260 GHz, which is based on the results of ECC Report 334 [i.9].

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 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 303 883-1 (V2.1.1) (2024-06): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 1: Measurement techniques for transmitter requirements".

[2] ETSI EN 303 883-2 (V2.1.1) (2024-06): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 2: Measurement techniques for receiver requirements".

[3] ETSI TS 103 789 (V1.1.1) (2023-05): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Radar related parameters and physical test setup for object detection, identification and RCS measurement".

[4] ETSI TS 103 941 (V1.1.1) (2024-01): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Measurement setups and specifications for testing under full environmental profile (normal and extreme environmental conditions)".

2.2 Informative references

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

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

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

[i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (RE-Directive).

[i.2] Commission implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.3] ECC/DEC/(22)03 of 18 November 2022 on technical characteristics, exemption from individual licensing and free circulation and use of specific radiodetermination applications in the frequency range 116-260 GHz, amended 8 March 2024.

[i.4] CEPT ERC Recommendation 74-01 (October 2021): "Unwanted emissions in the spurious domain".

[i.5] European Commission Implementing Decision (EU) 2022/180 amending Decision 2006/771/EC as regards the update of harmonised technical conditions in the area of radio spectrum use for short-range devices.

[i.6] IEC 61298-2:2008-10: "Process measurement and control devices - General methods and procedures for evaluating performance - Part 2: Tests under reference conditions".

[i.7] ETSI EG 203 336 (V1.2.1) (2020-05): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".

[i.8] ETSI TS 103 567 (V1.1.1) (2019-09): "Requirements on signal interferer handling".

[i.9] ECC Report 334: "UWB radiodetermination applications in the frequency range 116-260 GHz", January 2022, amended 2023.

[i.10] ETSI TS 103 361 (V1.1.1) (2016-03): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Receiver technical requirements, parameters and measurement procedures to fulfil the requirements of the Directive 2014/53/EU".

[i.11] ETSI TS 103 060 (V1.1.1) (2013-09): "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.12] Committee on Radio Astronomy Frequencies (CRAF), European Science Foundation.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 303 883-1 [1], ETSI EN 303 883-2 [2] and the following apply:

Duty Cycle over signal repetition period (DC_Trep): ratio of the sum of all the active sweep durations T_{on} (sweeps, scans) within the signal repetition period T_{rep}

NOTE: The signal repetition time T_{rep} here is equivalent to the $T_{meas,cycle}$ in the measurement standard ETSI EN 303 883-1 [1].

Frequency Modulated Continuous Wave (FMCW) radar: modulation scheme which is based on a periodically linear frequency sweep of the transmit signal

NOTE: See also clause E.1 and ETSI EN 303 883-1 [1], clause C.2.2.

step response time (of an LPR or TLPR): time span after a sudden distance change until the output value (distance value) reaches 90 % of the final value for the first time

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 303 883-1 [1], ETSI EN 303 883-2 [2] and the following apply:

f_{H_EUT}	Higher frequency of the EUT's actual operating frequency range
f_{L_EUT}	Lower frequency of the EUT's actual operating frequency range
f_{Rmin}	Regulated lower frequency limit of an operating frequency range
f_{Rmax}	Regulated upper frequency limit of an operating frequency range
T_{on}	ramp duration time for FMCW modulation schemes, i.e. it is the active radar sweep duration when the transmitter of the EUT is active

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 303 883-1 [1], ETSI EN 303 883-2 [2] and the following apply:

AUT	Antenna Under Test
e.i.r.p.	equivalent isotropically radiated power
EFTA	European Free Trade Union
IEC	International Electrotechnical Commission
ITU-R	International Telecommunication Union - Radio Sector
RCS	Radar Cross Section
SGA	Standard Gain Antenna

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use, but as a minimum, shall include that specified in the test conditions contained in the present document. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.2 EUT categories

4.2.1 General

The general requirements applicable for all TLPR and LPR are:

- Installation requirements from ECC/DEC/(22)03 [i.3] as listed in clause F for information.
- Receive-only devices, EUTs exhibiting a receive-only mode or a standby mode are not covered by the scope of the present document. Hence, Rx spurious emission is not covered by the present document.

The WTPC to cover the intended use for all EUTs addressed by the present document are defined in clause 4.4.2.

In order to provide a clear EUT categorization regarding the wanted performance criteria (as specified in clause 4.4.2), technical requirements, limits and test methods, the following sub-categories have been defined by:

- the used Operating Frequency Range (OFR), see clause 4.2.2;
- the used device type (T/LPR), see clause 4.2.3;
- the available antenna gain (GAIN), see clause 4.2.4;
- the used antenna connection (ANT), see clause 4.2.5.

4.2.2 Categorization by Operating Frequency Range (OFR)

The following categorization of LPR and TLPR EUTs by the Operating Frequency Range is used:

- OFR1: OFR of the EUT is contained in the frequency range 116 GHz to 148,5 GHz;
- OFR2: OFR of the EUT is contained in the frequency range 167 GHz to 182 GHz;
- OFR3: OFR of the EUT is contained in the frequency range 231,5 GHz to 250 GHz.

This categorization has been conducted, reflecting the different permitted frequency ranges which can be used for Level Probing Radars and Tank Level Probing Radars in accordance with ECC/DEC/(22)03 [i.3].

4.2.3 Categorization by device type

The following categorization of LPR and TLPR EUTs by the antenna connection is used:

- LPR: EUT intended to be installed and operated according to clause F.1;
- TLPR: EUT intended to be installed and operated within a tank according to clause F.2.

This categorization has been conducted, reflecting the two equipment types in accordance with ECC/DEC/(22)03 [i.3], clauses A.2.3 and A.2.5.

4.2.4 Categorization by antenna gain

The following categorization of LPR and TLPR EUTs by the antenna connection is used:

- GAIN1: EUT features an antenna with a high gain of $\geq$ 20 dBi;
- GAIN2: EUT features an antenna with a low gain of < 20 dBi.

This categorization has been conducted, reflecting the additional conducted peak power limit of 15 dBm for antenna gain < 20 dBi in accordance with ECC/DEC/(22)03 [i.3].

4.2.5 Categorization by antenna connection

The following categorization of LPR and TLPR EUTs by the antenna connection is used:

- ANT1: EUT features an antenna connector, e.g. the EUT is equipped with a dedicated antenna;
- ANT2: EUT has no antenna connector, e.g. the EUT is equipped with an integral antenna.

4.2.6 Summary of EUT categories

An overview of the applicability of transmitter requirements and receiver requirements for the different LPR and TLPR sub-categories is shown in Table 1 and Table 2, respectively.

Table 1: Applicability of transmitter requirements for the different EUT categories

TX requirements	Clause	Categorization by			
		operating frequency range (clause 4.2.2)	device type (clause 4.2.3)	antenna gain (clause 4.2.4)	antenna connection (clause 4.2.5)
		OFR1 to OFR3	TLPR and LPR	GAIN1 and GAIN2	ANT1 and ANT2
Operating frequency range	4.3.2	applicable to any category (OFR1 to OFR3)	applicable to any category (TLPR and LPR)	applicable to any category (GAIN1 to GAIN2)	applicable to any category (ANT1 to ANT2)
Mean e.i.r.p. spectral density	4.3.3				
Peak e.i.r.p. spectral density	4.3.4				
Maximum conducted peak power	4.3.5	applicable to any category (OFR1 to OFR3)	applicable to any category (TLPR and LPR)	applicable only to GAIN2	applicable to any category (ANT1 to ANT2)
Unwanted emission	4.3.6	applicable to any category (OFR1 to OFR3)	applicable to any category (TLPR and LPR)	applicable to any category (GAIN1 to GAIN2)	applicable to any category (ANT1 to ANT2)
Antenna gain requirement	4.3.7	applicable to any category (OFR1 to OFR3)	applicable to any category (TLPR and LPR)	applicable to any category (GAIN1 to GAIN2)	applicable to any category (ANT1 to ANT2)
Antenna pattern requirement	4.3.8	applicable to any category (OFR1 to OFR3)	applicable only to LPR	applicable to any category (GAIN1 to GAIN2)	applicable to any category (ANT1 to ANT2)
Duty Cycle requirement	4.3.9	applicable to any category (OFR1 to OFR3)	applicable only to LPR	applicable to any category (GAIN1 to GAIN2)	applicable to any category (ANT1 to ANT2)
TX behaviour under the complete environmental profile	4.3.10	applicable to any category (OFR1 to OFR3)	applicable to any category (TLPR and LPR)	applicable to any category (GAIN1 to GAIN2)	applicable only to ANT2 (see note)
NOTE: For EUTs with an antenna connector (ANT1), the maximum peak e.i.r.p. spectral density is considered under the complete environmental profile in clause 4.3.4.					

Table 2: Applicability of receiver requirements for the different categories

RX requirements	Clause	Categorization by			
		operating frequency range (clause 4.2.2)	device type (clause 4.2.3)	antenna gain (clause 4.2.4)	antenna connection (clause 4.2.5)
		OFR1 to OFR3	TLPR and LPR	GAIN1 and GAIN2	ANT1 and ANT2
Receiver baseline sensitivity (RBS)	4.4.3	applicable to any category (OFR1 to OFR3)	applicable to any category (TLPR and LPR)	applicable to any category (GAIN1 to GAIN2)	applicable to any category (ANT1 to ANT2)
Receiver baseline resilience (RBR)	4.4.4				