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Short Range Devices (SRD);
Ground- and Wall- Probing Radar applications (GPR/WPR) imaging systems;
Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU

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REN/ERM-TGUWB-138

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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.

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.

1 Scope

The present document specifies the requirements for Ground- and Wall- Probing Radar imaging systems applications. Ground Probing Radars (GPR) and Wall Probing Radars (WPR) are used in survey and detection applications.

The scope is limited to GPR and WPR radars, in which the system is in close proximity to the materials being investigated. It does not include radars operated from aircraft or spacecraft.

The GPR/WPR applications in the present document are not intended for communications purposes, and the intended signal is not radiated into free space.

NOTE: Equipment covered by the present document is intended to be used by competent professional personnel.

The present document applies to:

1) Ground Probing Radars (GPR) operating over approximately one decade in the frequency range 30 MHz to 12,4 GHz radiating directly downwards into the ground.

2) Wall Probing Radars (WPR) operating in the frequency range 30 MHz to 12,4 GHz radiating directly into a "wall". The "wall" is a building material structure, the side of a bridge, the wall of a mine or another physical structure that absorbs a significant part of the signal transmitted by the radar.

These equipment can either:

1) be fitted with integral antennas and without antenna connector; or

2) use different imaging heads (antennas) with an antenna connector, to allow operation at different operating bandwidths frequencies.

Equipment covered by the present document operates in accordance with ECC/DEC(06)08 "ECC Decision of 1 December 2006 on the conditions for use of the radio spectrum by Ground- and Wall- Probing Radar (GPR/WPR) imaging systems" [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 ranges of operation

Permitted range of operation (note 1)	
Transmit	30 MHz to 12,4 GHz
Receive	30 MHz to 12,4 GHz
Intended ranges of operation (preferred range of operating bandwidth) (note 2)	
Transmit	30 MHz to 12,4 GHz
Receive	30 MHz to 12,4 GHz
NOTE 1: Limits in table 2, clause 4.3.4 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 Directive 2014/53/EU [i.5].

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 (V1.1.0) (02-2016): "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".

[3] CISPR 16 (2014) (parts 1-1, 1-4 and 1-5): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".

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] ECC Decision of 1 December 2006 on the conditions for use of the radio spectrum by Ground- and Wall- Probing Radar (GPR/WPR) imaging systems, ECC/DEC/(06)08.

[i.3] ANSI C63.5-2004: "American National Standard for Electromagnetic Compatibility-Radiated Emission Measurements in Electromagnetic Interference (EMI) Control-Calibration of Antennas (9 kHz to 40 GHz)".

[i.4] ETSI TR 102 273 (V1.2.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties Part 1: Uncertainties in the measurement of mobile radio equipment characteristics; Sub-part 1: Introduction".

[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.

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:

exterior limits: regulatory limits defined and measured around a specific setup or measurement scenario

Pulse Repetition Frequency (PRF): inverse of the Pulse Repetition Interval (PRI), averaged over a sufficiently long time to cover all PRI variations

radiated measurements: measurements which involve the absolute measurement of a radiated field

user manual: the end user documentation to be included with the device

3.2 Symbols

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

dB	decibel
E	Electrical field strength
f_c	Frequency at which the emission is the peak power at maximum
λ	wavelength

3.3 Abbreviation

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

dBi	gain in decibels relative to an isotropic antenna
CEPT	European Conference of Postal and Telecommunications Administrations
DT	DwellTime
DUT	Device Under Test
e.r.p.	effective radiated power
GPR	Ground Probing Radar, Ground Penetrating Radar
OATS	Open Area Test Site
PRF	Pulse Repetition Frequency
PRI	Pulse Repetition Interval
RNSS	Radio Navigation Satellite Service
SA	Spectrum Analyser
ST	ScanTime
WPR	Wall Probing Radar

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 supplier. 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 12,4 GHz, as defined in table 1 of the present document. The intended range of operation gives the preferred range of operational frequencies for the UWB operation based on the allowed spectrum mask with increase 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 operational bandwidth of the UWB equipment under test, The operating bandwidth of the UWB equipment under test shall be the -10 dBc bandwidth of the intended UWB signal under normal operational conditions as defined in clause 4.3.1.

A single UWB device can have more than one operational bandwidth, for instance. One with a UWB operational bandwidth in the lower frequency range and one in the upper frequency range. All UWB related emissions shall be measured in the identified operational bandwidth of the UWB device under test. The required mitigation techniques are only valid in the operational bandwidth.

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

RX interference signal handling on the operating bandwidth and at defined frequencies below and above the operating range limits

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

4.3 Transmitter Conformance Requirements

4.3.1 Operating Bandwidth

4.3.1.1 Applicability

This requirement shall apply to all DUT.

4.3.1.2 Description

GPR/WPR applications are not intended for communications purposes. Their intended usage excludes radiation into the free space and this should be avoided due to a proper mechanism (see clause 4.7.7).

For these applications, the operating bandwidth(s) is/are the -10 dBc bandwidth(s) of effective emissions radiated into the air by the equipment.

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

This requirement does not apply to any DUT.

4.3.3 Maximum value of peak power

This requirement does not apply to any DUT.

4.3.4 Exterior Limits

4.3.4.1 Applicability

This requirement shall apply to all DUT.

4.3.4.2 Description

The emissions into the air resulting from the operation of GPR/WPR imaging systems are defined as those emissions radiated in all directions above the ground from the GPR/WPR equipment, including direct emissions from the housing/structure of the equipment and emissions reflected or passing through the media under inspection; they are therefore dependent on the operational conditions and are meaningful only if the GPR/WPR are coupled with the material being investigated.

4.3.4.3 Limits

The effective radiated power of any emission from GPR/WPR shall not exceed the values given in table 2.

Table 2: Power limits of radiated emissions [i.2]

Frequency range (MHz)	Peak power limit values for emission
30 to 230	-44,5 dBm/120 kHz (e.r.p)
> 230 to 1 000	-37,5 dBm/120 kHz (e.r.p)
> 1 000 to 18 000	-30 dBm/MHz (e.i.r.p.)

4.3.4.4 Conformance

The conformance test suite for Exterior Limit shall be as defined in clause 6.5.6 of the present document.

The maximum mean e.i.r.p. spectral density which is based on the peak values measured according to clause 6.5.6 shall be calculated as set out in annex F and shall not exceed the values in table F.1 ([i.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.

4.3.5 Total Power

This requirement does not apply to any DUT.

4.3.6 Other Emissions

This requirement does not apply to any DUT.

4.3.7 Transmitter unwanted emissions

This requirement does not apply to any DUT.

4.4 Receiver Conformance Requirements

4.4.1 Receiver requirements

Detailed description for related UWB receiver requirements, see ETSI TS 103 361 [2].

4.4.2 Receiver spurious emissions

Receiver spurious emissions are measured as part of the emissions resulting from the operation of GPR/WPR imaging systems, see clause 4.3.4.

4.4.3 Receiver interference handling

4.4.3.1 Applicability

This requirement shall apply to all DUT.

4.4.3.2 Description

Interferer signal handling, defined as the capability of the device to operate as intended in coexistence with 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]. 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 the recommended test case, see ETSI TS 103 361 [2].

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 tests for the interferer signal handling shall be done under normal test conditions as defined in clause 5.3.