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Wireless power transmission systems, using technologies other than radio frequency beam, in the 19 - 21 kHz, 59 - 61 kHz, 79 - 90 kHz, 100 - 300 kHz, 6 765 - 6 795 kHz ranges; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

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Foreword

This final 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 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.6] 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.3].

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Proposed national transposition dates	
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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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Introduction

The present document has been prepared to conform to the requirements of the new Radio Equipment Directive 2014/53/EU [i.3]. The present document covers wireless power transmission (WPT) systems using technologies other than radio frequency beam in the frequency ranges 19 - 21 kHz, 59 - 61 kHz, 79 - 90 kHz, 100 - 300 kHz, 6 765 - 6 795 kHz.

In the context of the present document "power transmission via radio frequency beam" means power transmission by radio waves.

For the clarification of open questions for high power wireless power transmission systems to charge vehicles a SRdoc ETSI TR 103 409 [i.4] was prepared. New specific requirements for such systems (e.g. higher H-field emission limits in the 79 - 90 kHz band) will be reflected within a future revision of 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 definitions, symbols and abbreviations used.

Clause 4 provides the technical requirements specifications, limits and conformance relative to transmitter and receiver.

Clauses 5 specifies the conditions for testing of the equipment and interpretation of the measurement results with the maximum measurement uncertainty values.

Clause 6 specifies the required measurement methods.

Annex A (informative) provides the relationship between the present document and the essential requirements of Directive 2014/53/EU [i.3].

Annex B (normative) provides the measurement setup specifically for Electric Vehicles.

1 Scope

The present document specifies technical characteristics and methods of measurements for wireless power transmission (WPT) systems, using technologies other than radio frequency beam, in the 19 - 21 kHz, 59 - 61 kHz, 79 - 90 kHz, 100 - 300 kHz, 6 765 - 6 795 kHz ranges.

The present document covers wireless power transmission systems which are regarded as radio equipment since including inherent radio communication functionality or radiodetermination via the WPT interface or port at the specific WPT frequency ranges.

Such systems usually consist of:

1) A power transmitter, with additional communication capability to control the charge function, in conjunction with the receiving part. The power transmitter could also be named as base station.

2) A power receiver, which supplies the received energy to a mobile device and performs a control/supervision function for the mobile device status and charge operation. Both parts in combination are able to transmit and receive data in addition to the power transmission mode e.g. to control the mobile device status and to optimize the power transmission mode.

These radio equipment types are capable of operating in the permitted frequency bands below 30 MHz as specified in Table 1.

The present document covers fixed systems, mobile and portable systems.

Table 1: WPT systems within the permitted frequency bands below 30 MHz

	WPT frequency range	Frequency Bands	Applications
Transmit and Receive	1	19 kHz to 21 kHz	WPT systems
Transmit and Receive	2	59 kHz to 61 kHz	WPT systems
Transmit and Receive	3	79 kHz to 90 kHz	WPT systems
Transmit and Receive	4	100 kHz to 119 kHz	WPT systems
Transmit and Receive		119 kHz to 140 kHz	WPT systems
Transmit and Receive		140 kHz to 148,5 kHz	WPT systems
Transmit and Receive		148,5 kHz to 300 kHz	WPT systems
Transmit and Receive	5	6 765 kHz to 6 795 kHz	WPT systems

NOTE 1: The frequency ranges listed in Table 1 are also used for generic inductive short range devices, according to ETSI EN 300 330 [1].

NOTE 2: The limits and the frequency ranges of the present document are EU wide harmonised according to EC Decision 2013/752/EU [i.2] and ERC/REC 70-03 [i.1].

NOTE 3: In addition, it should be noted that other frequency bands may be available in a country within the frequency range below 30 MHz.

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.3] under the conditions identified in Annex A.

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 300 330 (V2.1.1) (02-2017): "Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of 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] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".

[i.2] EC Decision 2013/752/EU: "Commission implementing Decision of 11 December 2013 amending Decision 2006/771/EC on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2005/928/EC".

[i.3] 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 Text with EEA relevance.

[i.4] ETSI TR 103 409: "System Reference document (SRdoc); Wireless Power Transmission (WPT) systems for Electric Vehicles (EV) operating in the frequency band 79 - 90 kHz".

[i.5] Void.

[i.6] 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.7] Void.

[i.8] Void.

[i.9] Void.

[i.10] CISPR document CIS/B/678/CD: "Amendment 2 Fragment 1 to CISPR 11 Ed. 6: Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement - Requirements for air-gap wireless power transfer (WPT)".

[i.11] Void.

[i.12] IEC 61980-1:2015: "Electric vehicle wireless power transfer (WPT) systems - Part 1: General requirements".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 300 330 [1] and the following apply:

99% OBW function: measurement function of a spectrum analyser

alignment: process or mechanical implementation of finding the relative position of base station and mobile device which allows a safe and efficient power transmission

NOTE: This alignment leads to the mechanical arrangement in which the WPT system is designed to operate.

base station: term used for the stationary part of the Wireless Power Transmission (WPT) system, a combination of a coil, communication device and/or connection to an energy supply

NOTE: Other expressions: charger, charging pad or primary coil.

co-location: WPT systems are designed to work within an alignment

NOTE: All operation modes require such a close proximity between the parts of the WPT system compared to the wave-length that all the parts of the WPT system can be seen as co-located.

Electric Vehicle (EV): vehicle using one or more electric motors for propulsion

mobile device: term used for the mobile part of the Wireless Power Transmission (WPT) system, comprising the combination of a coil, communication device and/or energy storage in one housing

Occupied Bandwidth (OBW): width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0,5 % of the total mean power of a given emission

NOTE: See Figure 1.

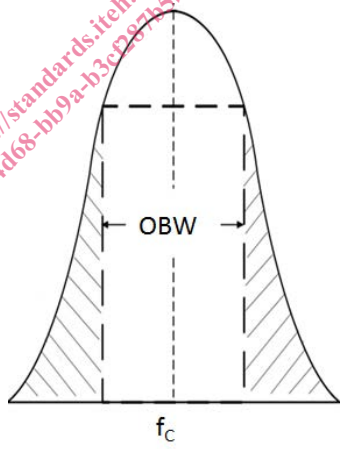

Figure 1: Occupied bandwidth (OBW)

power transmission via radio frequency beam: power transmission by radio waves are working in contrast to WPT systems in the scope of this document typically over larger distances between base station and mobile device (i.e. distance >> wavelength)

sub-mode: different emissions of an WPT system during one operational cycle within one operational mode (see Table 2)

test volume: volume in which the representative geometrical WPT system is in, including all cables, auxiliaries, etc.

vehicle emulator: necessary transmitting/receiving parts for a EV Wireless Power Transmission (WPT) test system (coil, communication device and representative mechanical vehicular arrangement)

worst-case alignment: alignment of primary coil (in the base station) and secondary coil (in the mobile device) which represents the worst case (e.g. with regards to emissions or efficiency)

NOTE: Typically, this is the case of lowest coupling between primary and secondary coil.

WPT system: combination of base station (stationary part) and mobile device for the typical use-cases, see clause 4.2.3

WPT system cycle time: time of a WPT system during one operation cycle in each operational mode

NOTE: This cycle time could include: power transmission, communication from base station / mobile device and back. These entire sub-operational modes could be on different frequencies.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 300 330 [1] and the following apply:

D	communication distance D for mode 2

NOTE: See Table 2.

d	measurement distance
L1, L2	connection points for ISN

NOTE: See clause 6.2.4.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 300 330 [1] and the following apply:

AMN	Artificial Mains Network
EV	Electric Vehicle
ISN	Impedance Stabilization Network
OFR	Operating Frequency Range
OOB	Out-Of-Band
SAC	Semi Anechoic Chamber
WPT	Wireless Power Transmission

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 which are identified as applicable in Annex A at all times when operating within the boundary limits of the declared operational environmental profile. The test conditions are defined in clause 5.3.

4.2 General

4.2.1 Background information

In this clause all general considerations for the testing of wireless power transmission (WPT) systems using technologies other than radio frequency beam in the 19 - 21 kHz, 59 - 61 kHz, 79 - 90 kHz, 100 - 300 kHz, 6 765 - 6 795 kHz ranges are given. The tests cover all different operational modes, as described in clause 4.2.3.

4.2.2 Wanted performance criteria

A WPT system always consists of a base station and a mobile device which are in proximity to each other. The performance of a WPT system is dependent on the related operational mode, see clause 4.2.3.

For the purpose of the receiver performance tests, the WPT system shall produce an appropriate output under normal conditions as indicated below:

- use as intended without degradation of performance; or
- a degradation of the performance is indicated by the WPT system as described in the manual.

The manufacturer shall declare the performance criteria used to determine the performance of the receiving parts inside the WPT system (related to the mode).

4.2.3 WPT operational modes

Because of the close interaction between base station and mobile device the manufacturer shall provide all necessary parts for the presentation of equipment and for testing purposes. The description of the setup including the positioning and mechanical orientation of both parts shall be provided since this affects the radiated emissions. For using different batteries or power receiving parts with one base station, the manufacturer shall declare the typical and the worst case combinations with regard to radiated emissions and provide such combinations for testing.

In certain cases it may be not possible to provide samples of all possible mobile devices due to unavailability. In these cases the manufacturer has to declare that the base station was developed based on certain mobile devices and such base station/mobile device combinations shall be provided for testing.

The manufacturer shall declare for each possible operation mode of the WPT system (overview see Table 2):

a) charging mode/power transmission/system in resonance;

b) communication mode (data transmission from and to the mobile device);

c) determination of the charging action e.g. to find the resonance frequency of the system or optimal charging parameters of the WPT systems.

Additional declarations to establish the appropriate test conditions:

a) the mechanical setup/alignment;

b) the maximum allowed values for the x-y-z offset within the alignment (worst-case alignment);

c) the mechanical orientation;

d) the permitted range of frequencies;

e) the range of operating conditions including the duty cycle or pulsing operational parameter;

f) power requirements;

g) information about which part of the WPT System can be interpreted as transmitter (mode dependent).

The measurements itself shall be done on these actual set-up and operating conditions for each mode.