

ETSI EN 303 454 V1.1.1 (2018-01)



**Short Range Devices (SRD);
Metal and object detection sensors
in the frequency range 1 kHz to 148,5 kHz;
Harmonised Standard covering the essential requirements
of article 3.2 of Directive 2014/53/EU**

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

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].

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.

National transposition dates

Date of adoption of this EN:	18 December 2017
Date of latest announcement of this EN (doa):	31 March 2018
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 September 2018
Date of withdrawal of any conflicting National Standard (dow):	30 September 2019

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 covers metal and object detection sensors in the frequency range 1 kHz to 148,5 kHz.

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.
- Clause 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].

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1 Scope

The present document specifies technical characteristics and methods of measurements for metal and object detection sensors in the frequency range 1 kHz to 148,5 kHz.

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.

The size for the inductive loops covered by the present document is limited to 3 m².

The present document does not cover other devices using the frequency range below 148,5 kHz, e.g. ETSI EN 303 348 [i.7] (Inductive loop for hearing impaired in 0 kHz to 20 kHz), ETSI EN 303 447 [i.8] (Inductive robotic mowers).

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

Table 1: Permitted range of operation

Permitted range of operation	
Transmit	1 kHz to 148,5 kHz
Receive	1 kHz to 148,5 kHz

NOTE: It should be noted that the frequency range between 9 kHz and 148,5 kHz is EU wide harmonised for inductive Short Range Devices according to Decision 2017/1483 [i.2].

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 Recommendation 70-03: "Relating to the use of Short Range Devices (SRD)".

- [i.2] Commission Implementing Decision (EU) 2017/1483 of 8 August 2017 amending Decision 2006/771/EC on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2006/804.
- [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.
- [i.4] CEPT/ERC/REC 74-01: "Unwanted emissions in the spurious domain".
- [i.5] ETSI EG 203 336: "Electromagnetic compatibility and Radio spectrum Matters (ERM); 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.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] ETSI EN 303 348: "Induction loop systems intended to assist the hearing impaired in the frequency range 10 Hz to 9 kHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [i.8] ETSI EN 303 447: "Short Range Devices (SRD); Inductive loop systems for robotic mowers in the frequency range 0 Hz to 148,5 kHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

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

detection: means the indication of any type of objects as declared by the manufacturer

object detector: capacitive and inductive devices which detect the presence of an object within the nearfield

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.

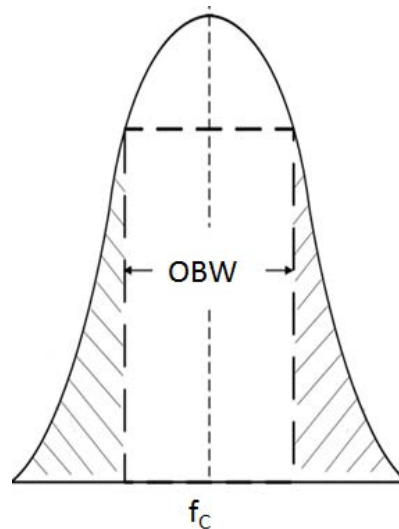


Figure 1: Occupied bandwidth (OBW)

3.2 Symbols

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

D	distance between EUT and the target during measurement
f_c	centre frequency of the OFR
f_H	highest frequency of the OFR
f_L	lowest frequency of the OFR
f_{sl}	frequency for the spurious emissions test (below f_c)
f_{sh}	frequency for the spurious emission test (above f_c)

3.3 Abbreviations

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

OBW	Occupied Bandwidth
OFR	Operating Frequency Range
OOB	Out of Band
RBW	Resolution Bandwidth

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 conditions shall be used as described in clause 5.3.

4.2 General

4.2.1 Wanted performance criteria

A metal and object detector is used to determine the presence of obscured objects made of conductive, magnetic, and/or dielectric materials such as non-ferrous metals, ferrous metals or wood. The objects are part of an environment, i.e. they are e.g. buried in the ground or embedded in building structures such as walls, floors, and ceilings.

The detection performance of the metal and object detector is measured in terms of the ability to detect objects from a specific set of objects in a specific set of environments up to a given maximum detection depth.

The manufacturer shall declare the specific set of objects, the specific set of environments, and the maximum detection depth for each of the relevant measurement modes.

The indications of objects by the EUT in the absence of objects are called false-positive indications.

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

- the objects in the specific set of objects, in the specific set of environments, up to the maximum detection depth/distance are indicated and no false-positive indications are observed; or
- a degradation of the detection performance is indicated by the EUT as described in the manual.

The possibilities for the indication of the degradation of the detection performance include in particular:

- indication by a dedicated means (e.g. specific light signal, specific tone signal, specific display content);
- indirect indication: the indicated detection result changes in short time intervals under otherwise stationary conditions.

4.2.2 Operational Modes

Metal and object detectors might have several operational modes:

- multiple measurement modes (one or several sensors switched on);
- non-measurement mode (sensors switched off).

The manufacturer shall declare the set of operational modes that are representative for the equipment.

The conformance measurements shall be performed in the representative set of operational modes.

Measurement modes might be specific but not limited to materials (e.g. metal, wooden studs), object properties (e.g. shape, diameter, depth), environments (e.g. concrete walls, dry walls), use case scenarios (e.g. finding, avoiding, tracing), sensitivities (e.g. high sensitivity, medium sensitivity, low sensitivity) or combinations thereof (e.g. universal mode).

The working principles of the sensors in the various modes might include continuous transmission (either stand-alone or in parallel) and intermittent transmission (either alternating or in parallel). The receivers of the sensors might be either switched on continuously or intermittent. In particular, receivers might at times be switched on while the respective transmitter is switched off (receiver only operation).

4.2.3 Presentation of equipment for testing purposes

Each EUT submitted for testing shall fulfil the requirements of the present document.

The manufacturer shall declare the range of operating conditions and power requirements as applicable, to establish the appropriate test conditions.

Additionally, technical documentation and operating manuals, sufficient to make the test, shall be supplied.

Measurements shall be performed for all operational modes from clause 4.2.2 on samples of equipment defined in clause 4.2.2 of ETSI EN 300 330 [1].

4.3 Transmitter conformance requirements

4.3.1 Operating Frequency Range (OFR)

4.3.1.1 Applicability

This requirement applies to all EUT.

4.3.1.2 Description

The operating frequency range is the frequency range over which the EUT is intentionally transmitting. The operating frequency range of the EUT is determined by the lowest (f_L) and highest frequency (f_H) as occupied by the power envelope.

The EUT could have more than one operating frequency range.

For single frequency systems the OFR is equal to the occupied bandwidth (OBW) of the EUT.

For multi-frequency systems, the OFR extends from the lowest edge of the OBW when operating on the lowest frequency to the highest edge of the OBW when operating on the highest frequency, for example as illustrated in figure 2.

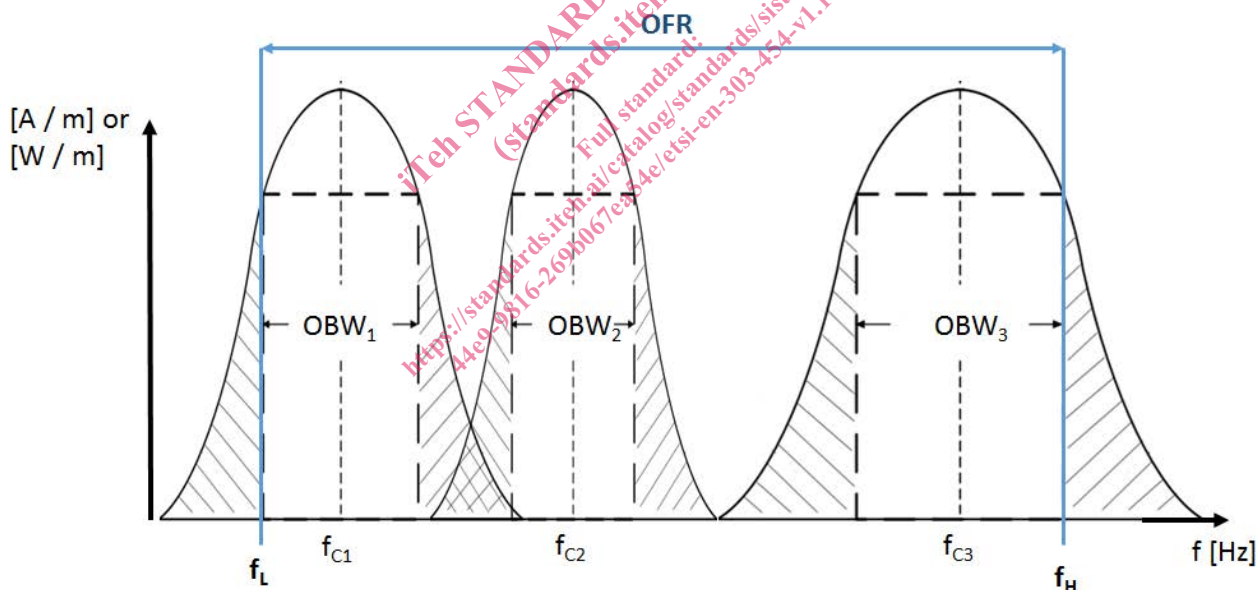


Figure 2: OFR of a multi - frequency system

4.3.1.3 Limits

The operating frequency range shall be within the following limits:

- Upper edge of the operating frequency range: $f_H \leq 148,5$ kHz.
- Lower edge of the operating frequency range: $f_L \geq 1$ kHz.

For the later unwanted emission measurement procedure in clause 4.3.3.3 the OFR shall be calculated as: $f_H - f_L$ and the centre frequency as: $f_c = \frac{f_H + f_L}{2}$.