



**Navigation radar for use on non-SOLAS vessels;  
Harmonised Standard covering the essential requirements of  
article 3.2 of the Directive 2014/53/EU**

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# Contents

Intellectual Property Rights .....	5
Foreword.....	5
Modal verbs terminology.....	5
1 Scope .....	6
2 References .....	6
2.1 Normative references .....	6
2.2 Informative references.....	7
3 Definitions, symbols and abbreviations .....	7
3.1 Definitions.....	7
3.2 Symbols.....	7
3.3 Abbreviations .....	8
4 Testing for compliance with technical requirements.....	8
4.1 Environmental conditions for testing .....	8
4.1.0 General.....	8
4.1.1 Standard operating mode of the radar equipment .....	8
5 General conditions of measurement .....	9
5.1 Test conditions, power sources and ambient temperatures.....	9
5.1.1 Normal test conditions .....	9
5.1.1.1 Normal temperature and humidity .....	9
5.1.1.2 Normal test power supply .....	9
5.1.1.2.0 General .....	9
5.1.1.2.1 AC test power supply .....	9
5.1.1.2.2 DC test power supply .....	9
5.1.2 Extreme test conditions.....	9
5.1.2.1 Extreme temperatures.....	9
5.1.2.1.1 Protected unit.....	9
5.1.2.1.2 Outdoor unit .....	10
5.1.2.2 Extreme power supply voltage test conditions.....	10
6 Radio tests .....	10
6.1 Radiated emissions .....	10
6.1.1 Definition.....	10
6.1.2 Method of measurement .....	10
6.1.2.1 General.....	10
6.1.2.2 Frequency band 156 MHz to 165 MHz method 1.....	11
6.1.2.3 Frequency band 156 MHz to 165 MHz method 2.....	11
6.1.3 Limits.....	11
6.2 Operating frequency .....	11
6.2.1 Definition.....	11
6.2.2 Method of measurement .....	11
6.2.3 Limits.....	12
6.3 Transmitter pulse power .....	12
6.3.1 Definition.....	12
6.3.2 Method of measurement .....	12
6.3.3 Limits.....	12
6.4 Out of band emissions .....	12
6.4.1 Definition.....	12
6.4.1.0 General .....	12
6.4.1.1 Non-FM pulse radar .....	12
6.4.1.2 FM pulse radars.....	13
6.4.1.3 Other modulation formats .....	13
6.4.2 Method of measurement .....	13
6.4.3 Limits.....	14
6.4.3.1 Out of band limits .....	14
6.4.3.2 Out of band limits (excluded types) .....	14

6.5	Radiated spurious emissions.....	15
6.5.1	Definition.....	15
6.5.2	Method of measurement .....	15
6.5.3	Limits.....	16
6.6	Minimum range .....	16
6.6.1	Definition.....	16
6.6.2	Method of measurement .....	16
6.6.3	Limits.....	16
6.7	Range discrimination.....	16
6.7.1	Definition.....	16
6.7.2	Method of measurement .....	16
6.7.3	Limits.....	17
6.8	Bearing discrimination .....	17
6.8.1	Definition.....	17
6.8.2	Method of measurement .....	17
6.8.3	Limits.....	17
6.9	Range of first detection in minimal clutter .....	17
6.9.1	Definition.....	17
6.9.2	Method of measurement .....	17
6.9.3	Limits.....	17
7	Testing for compliance with technical requirements.....	18
7.1	Environmental conditions for testing .....	18
7.2	Interpretation of the measurement results .....	18
<b>Annex A (normative):</b>	<b>Relationship between the present document and the essential requirements of Directive 2014/53/EU.....</b>	<b>19</b>
<b>Annex B (normative):</b>	<b>Transmission power and unwanted emissions of radar systems; measuring methods.....</b>	<b>20</b>
B.1	Indirect connection via the rotating joint.....	20
B.2	Maximum permitted out of band emissions power levels.....	21
B.3	Maximum permitted spurious emissions power levels .....	21
History	.....	22

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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.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.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
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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).

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

# 1 Scope

The present document applies to non-SOLAS radar equipment.

The applicable frequencies of operation of this type of radio equipment are given in table 1. These frequencies are allocated to the radio navigation service, as defined in article 5 of the Radio Regulations [i.3].

**Table 1: Radio navigation service frequencies**

	<b>Radio navigation service frequencies</b>
Transmit	2 900 MHz to 3 100 MHz
Receive	2 900 MHz to 3 100 MHz
Transmit	9 300 MHz to 9 500 MHz
Receive	9 300 MHz to 9 500 MHz

The present document contains requirements to demonstrate that radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of Article 3 of the Radio Equipment Directive (RED) [i.1] may apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site <http://www.newapproach.org>.

## 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] Void.
- [2] Recommendation ITU-R M.1177-4 (2011): "Techniques for measurement of unwanted emissions of radar systems".
- [3] Recommendation ITU-R SM.1541-6 (2015): "Unwanted emissions in the out-of-band domain".
- [4] ETSI TR 100 028-1 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".
- [5] ETSI TR 102 273 (V1.2.1) - (12-2001) - (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".
- [6] ETSI TS 103 052 (V1.1.1) (03-2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".
- [7] Void.
- [8] CISPR 16-1-1:2015: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".

- [9] CISPR 16-1-4:2010: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements".
- [10] IEC 62388:2013: "Maritime navigation and radiocommunication equipment and systems - Shipborne radar - Performance requirements, methods of testing and required test results".

## 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] Void.
- [i.3] ITU Radio Regulations (2012).
- [i.4] Void.
- [i.5] ETSI TR 100 028-2 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [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.

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**radar cross-section:** determines the power density returned to the radar for a particular power density incident on a target

**radar echo:** signal reflected by a target to a radar antenna that appears in the radar video signal and radar image

### 3.2 Symbols

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

$B_{-40}$	-40 dB bandwidth
$P_m$	Transmission mean power
$P_t$	Transmission pulse power
$t$	Time
$t_p$	Transmission pulse duration
$t_r$	Pulse rise time

### 3.3 Abbreviations

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

AC	Alternating Current
CISPR	Comité International Spécial des Perturbations Radioélectriques
CW	Carrier Wave
DC	Direct Current
EBL	Electronic Bearing Line
EFTA	European Free Trade Association
EUT	Equipment Under Test
FM	Frequency Modulation
FMCW	Frequency Modulated Carrier Wave
FTC	Fast Time Constant
IEC	International Electrotechnical Committee
ITU-R	International Telecommunications Union - Radiocommunications
LNA	Low Noise Amplifier
NM	Nautical Mile
OOB	Out Of Band
PEP	Peak Envelope Power
PRT	Pulse Repetition Time
RCS	Radar Cross-Section
RED	Radio Equipment Directive
RF	Radio Frequency
RJ	Rotary Joint
SOLAS	Safety Of Life At Sea
STC	Sensitivity Time Control
VRM	Variable Range Marker

## 4 Testing for compliance with technical requirements

### 4.1 Environmental conditions for testing

#### 4.1.0 General

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the supplier, but as a minimum, shall be 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 declared operational environmental profile.

#### 4.1.1 Standard operating mode of the radar equipment

Unless otherwise stated the radar equipment shall be set to the standard operating mode which is understood to be as follows:

Operation state:	transmitting with antenna turning;
Antenna height:	15 m;
Pulse Width:	shortest;
TUNE setting:	optimal;
GAIN setting:	optimal;
STC setting:	off;
FTC setting:	off;
Range rings:	visible;
VRM:	visible;



EBL: visible;

Brilliance of all attributes: optimal (well readable).

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## 5 General conditions of measurement

### 5.1 Test conditions, power sources and ambient temperatures

#### 5.1.1 Normal test conditions

##### 5.1.1.1 Normal temperature and humidity

The temperature and humidity conditions for tests shall be a combination of temperature and humidity within the following ranges:

- a) temperature: +15 °C to +35 °C; or within the manufacturers stated operating range and stated in the report;
- b) relative humidity: 20 % to 75 %.

When the relative humidity is lower than 20 %, it shall be stated in the test report.

##### 5.1.1.2 Normal test power supply

###### 5.1.1.2.0 General

For the purpose of the present document, the test power supply shall be the primary input source that the equipment is designed for. If the equipment is designed for direct connection to DC power supplies then that shall take precedent over a combination using an AC adaptor.

###### 5.1.1.2.1 AC test power supply

The test voltage for equipment to be connected to an AC supply shall be the nominal mains voltage declared by the manufacturer -10 % to +10 %. For the purpose of the present document, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment is indicated as having been designed. The frequency of the test voltage shall be 50 Hz  $\pm$  1 Hz.

###### 5.1.1.2.2 DC test power supply

Where the equipment is designed to operate from a DC source, the normal test voltage shall be the nominal voltage as declared by the manufacturer -10 % to +20 %.

The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of testing the power source voltage shall be measured at the input terminals of the equipment.

During testing, the power source voltages shall be maintained within a tolerance of  $\pm$ 3 % relative to the voltage level at the beginning of each test.

#### 5.1.2 Extreme test conditions

##### 5.1.2.1 Extreme temperatures

###### 5.1.2.1.1 Protected unit

The temperature and humidity conditions for extreme tests shall be a combination of nominal temperature and humidity within the following ranges:

- a) temperature: 0 °C to +40 °C;
- b) relative humidity: 20 % to 75 %.

When the relative humidity is lower than 20 %, it shall be stated in the test report.

### 5.1.2.1.2 Outdoor unit

The temperature and humidity conditions for extreme tests shall be a combination of nominal temperature and humidity within the following ranges:

- a) temperature: -20 °C to +55 °C;
- b) relative humidity: 20 % to 93 %.

When the relative humidity is lower than 20 %, it shall be stated in the test report.

### 5.1.2.2 Extreme power supply voltage test conditions

The extreme power supply test voltages applied to the equipment shall be according to table 2.

**Table 2: Extreme power supply voltage and frequency tolerances**

Power supply	Voltage variation (%)	Frequency variation (%)
AC	±10	±5
DC	+20 -10	Not applicable

## 6 Radio tests

### 6.1 Radiated emissions

#### 6.1.1 Definition

Radiated electromagnetic emissions are to be understood as any signals radiated by the completely assembled and operated radar equipment, other than the operating frequency, with its spectra, which can potentially disturb other equipment on the ship, such as radio receivers or rate of turn indicators.

#### 6.1.2 Method of measurement

##### 6.1.2.1 General

On a test site selected from clause 5 of ETSI TS 103 052 [6], the EUT shall be placed on a non-conductive support with a height of 1,5 m.

The quasi-peak measuring receivers specified in CISPR 16-1-1 [8] shall be used. The receiver bandwidth in the frequency ranges 150 kHz to 30 MHz shall be 9 kHz and in the frequency ranges 30 MHz to 2 GHz shall be 120 kHz.

For frequencies from 150 kHz to 30 MHz measurements shall be made of the magnetic H field. The measuring antenna shall be an electrically screened loop antenna of dimension so that the antenna can be completely enclosed by a square having sides of 60 cm in length, or an appropriate ferrite rod as described in CISPR 16-1-4 [9]. The correction factor for the antenna shall include the factor +51,5 dB to convert the magnetic field strength to equivalent electric field strength.

For frequencies above 30 MHz measurements shall be made of the electric E field. The measuring antenna shall be a balanced dipole of resonant length, or alternate shortened dipole or higher gain antenna as described in CISPR 16-1-4 [9]. The dimension of the measuring antenna in the direction of the EUT shall not exceed 20 % of its distance from the EUT. At frequencies above 80 MHz it shall be possible to vary the height of the centre of the measuring antenna above the ground over a range of 1 m to 4 m.

The EUT shall be fully assembled, complete with its associated interconnecting cables and mounted in its normal plane of operation.