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*European Standard (Telecommunications series)*

## **Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for maritime radiotelephone watch receivers operating on 2 182 kHz**

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## Foreword

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

Other standards cover radiocommunications equipment not listed in the scope.

The present document is based upon EN 60945 [10].

The present EN has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 83/189/EEC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present EN, together with ETS 300 441 [9] is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility ("the EMC Directive") (89/336/EEC [8] as amended).

Technical specifications relevant to the EMC Directive are given in annex A.

National transposition dates	
Date of adoption of this EN:	18 September 1998
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# 1 Scope

The present document covers the assessment of radiocommunication and ancillary equipment in respect of Electromagnetic Compatibility (EMC). Technical specifications related to the antenna port are found in the related product standard ETS 300 441 [9] for the effective use of the radio spectrum.

The present document specifies the applicable EMC tests, the test methods, the limits and the minimum performance criteria for maritime radiotelephone watch receivers operating on 2 182 kHz and the associated ancillary equipment.

The electromagnetic environment used in the present document to develop the technical specifications encompasses the electromagnetic environment on board ships as identified in EN 60945 [10].

The EMC requirements have been selected to ensure an adequate level of compatibility for apparatus in maritime environments. The levels do not cover extreme cases which may occur in any location but have a low probability of occurrence.

Compliance of radio equipment to the requirements of the present document does not signify compliance to any requirements related to the use of the equipment.

Compliance to the present document does not signify compliance to any safety requirements. However, it is the responsibility of the assessor of the equipment that any observations regarding apparatus becoming dangerous or unsafe as a result of the application of the tests defined in the present document, should be recorded in the test report.

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# 2 Normative references

References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or
- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus".
- [2] EN 55022: "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".
- [3] EN 61000-4-2: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test".
- [4] EN 61000-4-4 (1995): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test".
- [5] EN 61000-4-5 (1995): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test".
- [6] EN 61000-4-6: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields".
- [7] EN 61000-4-3 (1995): "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test".

- [8] 89/336/EEC: "Council Directive on approximation of the laws of the Member States relating to electromagnetic compatibility".
- [9] ETS 300 441: "Radio Equipment and Systems (RES); Technical characteristics and methods of measurement for maritime radiotelephone watch receivers for the distress and calling frequency 2 182 kHz".
- [10] EN 60945: "Marine navigational equipment - General requirements - Methods of testing and required test results".
- [11] ETS 300 113: "Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector".

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## 3 Definitions and abbreviations

### 3.1 Definitions

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

**ancillary equipment:** Equipment (apparatus), used in connection with a receiver, transmitter or transceiver is considered as an ancillary equipment (apparatus) if:

- the equipment is intended for use in conjunction with a receiver, transmitter or transceiver to provide additional operational and/or control features to the radio equipment (e.g. to extend control to another position or location); and
- the equipment cannot be used on a stand alone basis to provide user functions independently of a receiver, transmitter or transceiver; and
- the receiver, transmitter or transceiver to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment, i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions.

**artificial antenna:** A non-radiating load of 10  $\Omega$  in series with 250 pF.

**signal & control port:** A port which carries information or control signals, excluding antenna ports.

**antenna port:** A port which is intended for direct or indirect connection to an antenna.

**enclosure port:** The physical boundary of the apparatus onto which an electromagnetic field may radiate or impinge.

**Equipment Under Test (EUT):** The EUT comprises one or more units and their interconnecting cables as necessary for it to perform its intended functions.

**port:** A particular interface of specified equipment (apparatus) with the external electromagnetic environment.

**rated output power:** The value stated by the manufacturer to be the maximum power available at the receiver output, for which certain requirements are met.

### 3.2 Abbreviations

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

EMC	ElectroMagnetic Compatibility
IMO	International Maritime Organization
SOLAS	Safety Of Life At Sea
EUT	Equipment Under Test
RF	Radio Frequency
AC	Alternating Current

DC	Direct Current
emf	electromotive force
rms	root mean square
SND/N	Signal + Noise + Distortion / Noise

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## 4 General test conditions

This clause defines the general test configuration and is relevant for clauses 8 and 9.

### 4.1 Test conditions and configurations

The test shall be carried out at normal temperature and humidity with the equipment connected to the normal power supply voltage. All tests shall be performed with the wanted signal on the operating frequency 2 182 kHz unless otherwise stated.

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

temperature: +15°C to +35°C;

relative humidity: 20 % to 75 %.

The normal test voltage for equipment to be connected to the AC mains, shall be the nominal mains voltage. The frequency of the test voltage shall be 50 Hz  $\pm$  1 Hz.

The normal test voltage for equipment to be connected to a battery, shall be the nominal voltage of the battery (12 V, 24 V, etc.). For operation from other power sources, the normal test voltage shall be declared by the manufacturer.

The test configuration shall be as close as possible to normal intended use.

If the equipment is part of a system, or can be connected to ancillary equipment, then it shall be acceptable to test the equipment while connected to the minimum representative configuration of ancillary equipment necessary to exercise the ports.

Ports which in normal operation are connected shall be connected to an ancillary equipment or to a representative piece of cable correctly terminated to simulate the input/output characteristics of the ancillary equipment. RF input ports shall be correctly terminated.

If the equipment has a large number of ports, then a sufficient number shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are tested.

Ports which are not connected to cables during normal intended operation, e.g. service connectors, programming connectors, temporary connectors etc. shall not be connected to any cables for the purpose of EMC testing. Where cables have to be connected to these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables.

The test conditions, test configuration and mode of operation shall be recorded in the test report.

#### 4.1.1 Emission tests

This subclause defines the test conditions and configurations for the emission tests as follows:

- the measurement shall be made in the operation mode producing the largest emission in the frequency band being investigated consistent with normal applications;
- an attempt shall be made to maximize the detected radiated emissions for example by moving the cables of the equipment.



### 4.1.2 Immunity tests

This subclause defines the test conditions and configurations for the immunity tests as follows:

- the measurement shall be made in the mode of operation as required in subclause 4.1.2.1;
- for the immunity tests of ancillary equipment without separate pass/fail criteria, the receiver, transmitter or transceiver coupled to the ancillary equipment, shall be used to judge whether the ancillary equipment passes or fails.

#### 4.1.2.1 Mode of operation

For the immunity tests, the wanted input signal, coupled to the receiver, shall be the normal test signal a) (subclause 4.1.2.2) except where otherwise stated.

For immunity tests requiring performance criterion A, the EUT shall be put in the non-muted state before the test.

For immunity tests requiring performance criteria B or C, the EUT shall be put in the muted state before the test.

#### 4.1.2.2 Normal test signal

The following normal test signals are defined:

- a) an A2A signal on the frequency of 2 182 kHz with a level of 60 dB $\mu$ V (emf) modulated with 1 kHz to a depth of 30 %;
- b) an A2A signal on the frequency of 2 182 kHz with a level of 60 dB $\mu$ V (emf) modulated with the radiotelephone alarm signal (see ETS 300 441 [9]) to a depth of 70 %.

#### 4.1.2.3 Arrangements for test signals at the input of the receiver

Test signal sources shall be connected to the receiver input in such a way that the impedance presented to the receiver input is 50  $\Omega$ .

Adequate measures shall be taken to avoid the effect of the unwanted signal on the measuring equipment.

#### 4.1.2.4 Receiver exclusion band

The exclusion band is the frequency range 2 065 kHz to 2 300 kHz.

#### 4.1.2.5 Narrow band responses

Responses occurring during the test at discrete frequencies which are narrow band responses (spurious responses) are identified by the method specified in this subclause.

If an unwanted signal causes an SND/N of less than 10 dB it is necessary to establish whether the distortion is due to a narrowband response or to wideband phenomena.

Taking the initial test frequency as reference the procedure is repeated with an increase of the unwanted signal frequency by 40 kHz.

If the SND/N recovers to not less than 10 dB, then the response is considered as a narrowband response.

If the SND/N is still less than 10 dB, the test is repeated with the frequency of the unwanted signal decreased by 40 kHz.

If the SND/N recovers to not less than 10 dB, the response is considered as a narrowband response.

If the SND/N is still less than 10 dB, this may be due to the fact that the offset has made the frequency of the unwanted signal correspond to the frequency of another narrowband response.

Therefore, taking the initial test frequency as reference the procedure is repeated with an increase of the unwanted signal frequency by 50 kHz.

If the SND/N recovers to not less than 10 dB the response is considered as a narrowband response. If the SND/N is still less than 10 dB, the test is repeated with the frequency of the unwanted signal decreased by 50 kHz.

If the SND/N is still less than 10 dB, the phenomenon is considered wideband and therefore an EMC problem and the equipment fails the test.

All narrowband responses shall be disregarded.

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## 5 Performance assessment

### 5.1 General

The manufacturer shall, supply the following information to be recorded in the test report:

- the ancillary equipment to be combined with the radio equipment for testing (where applicable);
- an exhaustive list of ports, with the maximum cable lengths allowed, classified as either power, signal or control. Power ports shall further be classified as AC or DC power.

### 5.2 Ancillary equipment

At the manufacturers discretion an ancillary equipment may be:

- declared compliant separately from the receiver to all the applicable immunity and emission clauses of the present document;
- declared compliant to another appropriate harmonized EMC standard;
- tested with it connected to the receiver in which case compliance shall be demonstrated to the appropriate clauses of the present document.

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## 6 Performance criteria

### 6.1 General

The equipment shall meet the minimum performance criteria as specified in subclauses 6.2, 6.3, 6.4, for the tests indicated in table2 (clause 7).

### 6.2 Performance criteria A for continuous phenomena

The EUT shall continue to operate as intended during and after the test. A performance check as specified in subclause 6.5 shall be performed during the test sequence and there shall be no change of the EUT settings.

### 6.3 Performance criteria B for transient phenomena

The EUT shall continue to operate as intended after the test and there shall have been no change of the EUT settings.

A performance check as specified in subclause 6.5 shall be performed after the test.

### 6.4 Performance criteria C

Temporary degradation or loss of function is permitted during the test sequence. After this test, any degradation or loss of function shall be self recoverable or restorable by operation of user controls.

## 6.5 Performance check

The term "performance check" is taken to mean a measurement of:

- SND/N.

The normal test signal a) (see subclause 4.1.2.2) shall be applied to the input of the receiver. The receiver shall be in the unmuted state. The audio output shall be adjusted to standard output power (see ETS 300 441 [9]). The SND/N shall be not less than 10 dB.

- Mute response.

The receiver input signal shall be removed. The receiver shall be in the muted state. The normal test signal b) (see subclause 4.1.2.2) shall then be applied to the input of the receiver and the mute shall lift within six seconds.

## 7 Applicability overview tables

### 7.1 Emissions

**Table 1: Emissions overview**

<b>Application</b>	<b>Test requirements</b>	<b>Reference subclause</b>	<b>Reference document</b>
Radiated emissions	applicable	8.1	EN 60945 [10] CISPR 16-1 [1]
DC power in/out	applicable	8.2	EN 60945 [10] CISPR 16-1 [1]
Radiated emissions (enclosure)	applicable	8.3	ETS 300 113 [11]
AC mains	applicable	8.2	EN 60945 [10] CISPR 16-1 [1]

## 7.2 Immunity

**Table 2: Immunity overview**

Phenomena	Application	Test requirements	Reference subclause in the present document	Reference
RF electro-magnetic field 80 MHz to 1 000 MHz	Enclosure	applicable	9.1	EN 61000-4-3 [7]
Electrostatic discharge	Enclosure	applicable	9.2	EN 61000-4-2 [3]
Fast transient	AC/DC power input ports and signal and control ports	applicable cables > 3 m for DC power and signal and control ports	9.3	EN 61000-4-4 [4]
RF common mode 150 kHz to 80 MHz	Signal & control ports DC & AC power ports	applicable cables > 3 m for DC power and signal and control ports	9.4	EN 61000-4-6 [6]
Short term power supply variations	AC power input ports	applicable	9.5	EN 60945 [10]
Power supply failure	AC power input ports	applicable	9.6	EN 60945 [10]
Surges	AC power input ports	applicable	9.7	EN 61000-4-5 [5]

---

## 8 Methods and limits for emission measurements

The individual tests called up in the table 1 shall be performed in accordance with the basic standard specified in each case. Any deviations from this principle are elaborated in the text.

The applicability of tests to specific classes of equipment are elaborated in subclause 7.1.

The tests shall be performed in the receive mode of operation.

### 8.1 Radiated emissions

This test is applicable to the enclosure port of the EUT.

This test shall be performed on a representative configuration of the radio equipment or a representative configuration of the combination of radio and ancillary equipment.

#### 8.1.1 Definition

This test assesses the ability of the EUT to limit unwanted emissions from the enclosure.

## 8.1.2 Test method, general

The measuring bandwidth shall be in accordance with table 3.

**Table 3: Measuring bandwidth - radiated emissions**

Frequency range	Measuring bandwidth
150 kHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1 GHz	100 kHz to 120 kHz
156 MHz to 165 MHz	9 kHz to 10 kHz

The setting of controls which may affect the level of radiated interference shall be varied in order to ascertain the maximum emission level.

When the EUT consists of more than one unit the interconnecting cables shall have the maximum length as indicated by the manufacturer.

Available input and output ports shall be connected to the maximum length of cable as indicated by the manufacturer and terminated to simulate the impedance of the ancillary equipment.

These cables shall be bundled at the approximate centre of the cable with the bundles of 30 cm to 40 cm in length running in the horizontal plane from the port to which it is connected. If it is impractical to do so because of cable bulk or stiffness, the disposition of the excess cable shall be precisely noted in the test report.

The emissions shall be measured in the frequency range of 150 kHz to 1 GHz in accordance with CISPR Publ. 16-1 [1] using the measuring receiver or a comparable spectrum analyser.

During the measurements the quasi-peak detector shall be used.

### 8.1.2.1 Test method, frequency range 150 kHz to 30 MHz

This test is applicable to the enclosure port of radio equipment and ancillary equipment for the frequency range 150 kHz to 30 MHz.

The test shall be performed on a representative configuration of the radio equipment or a representative configuration of the combination of radio and ancillary equipment.

The test method shall be in accordance with EN 60945 [10].

The EUT shall be placed on a non-conductive support with a height of 1,5 m. The measuring distance between the centre of the test antenna and the EUT shall be 3 m. The test site as indicated in EN 60945 [10] and CISPR Publ. 16-1 [1] shall be used.

### 8.1.2.2 Test method, frequency range 30 MHz to 1 GHz

This test is applicable to the enclosure port of separately tested ancillary equipment, i.e. not connected to the radio equipment, for the frequency range 30 MHz to 1 GHz.

The test method applied shall be in accordance with EN 55022 [2] (see table 4).

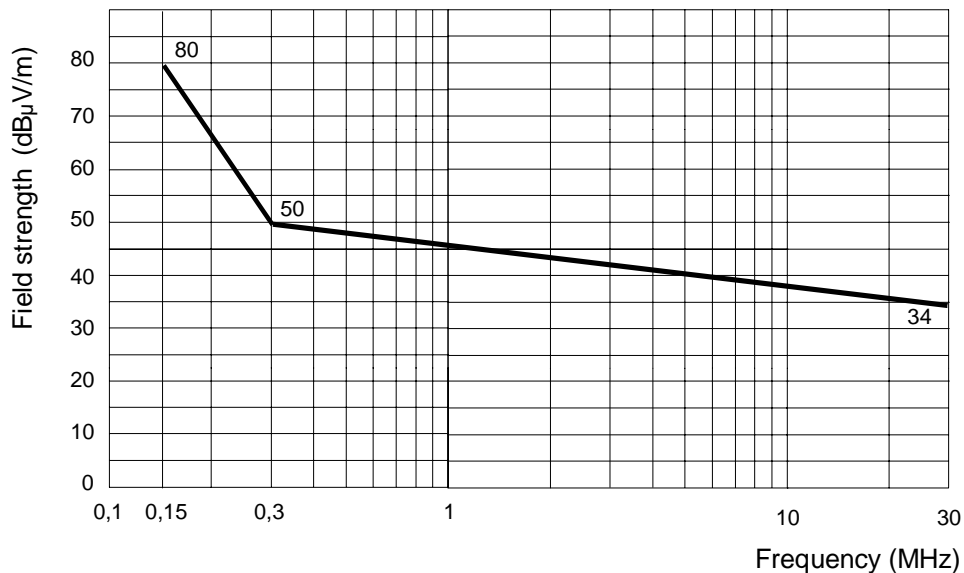
### 8.1.3 Limits

The levels of field strength of any radiated spurious emission of the EUT in the frequency range 150 kHz to 1 GHz shall not exceed the values given in table 4 (see also figure 1).

**Table 4: Spurious emissions limits**

Frequency range	Limit (Quasi Peak)	Measuring distance
150 kHz to 300 kHz	80 dB $\mu$ V/m to 50 dB $\mu$ V/m (Note)	3 m
300 kHz to 30 MHz	50 dB $\mu$ V/m to 34 dB $\mu$ V/m (Note)	3 m
> 30 MHz to 230 MHz	30 dB $\mu$ V/m	10 m
> 230 MHz to 1 GHz	37 dB $\mu$ V/m	10 m
156 MHz to 165 MHz	24 dB $\mu$ V/m	3 m

NOTE: The limit decreases linearly with the logarithm of frequency.



**Figure 1: Maximum level of radiated spurious emissions  
(within the range 150 kHz to 30 MHz)**

## 8.2 Power ports

This test shall be performed on a representative configuration of the radio equipment or a representative configuration of the combination of radio and ancillary equipment.

### 8.2.1 Definition

This test assesses the ability of the EUT to limit internal noise from the power ports.

### 8.2.2 Test method

The power input cable(s) between AC and/or DC input ports of the EUT and the artificial mains network shall be screened and not exceed 0,8 m in length.

If the EUT consists of more than one unit with individual AC and/or DC power input ports, power input ports of identical nominal supply voltages shall be connected in parallel to the artificial mains network.

The setting of controls which may affect the level of conducted interference shall be varied in order to ascertain the maximum emission level.

The measuring bandwidth in the frequency range 10 kHz to 150 kHz shall be 200 Hz and in the frequency range 150 kHz to 30 MHz shall be 9 kHz to 10 kHz.

The emissions shall be measured in the frequency range of 10 kHz to 30 MHz by means of a measuring receiver and an artificial mains V-network ( $50\ \Omega/50\ \mu\text{H} + 5\ \Omega$ ) in accordance with CISPR 16-1 [1].

During the measurements the quasi-peak detector shall be used.

### 8.2.3 Limits

The level of any conducted spurious signal shall not exceed the values given in figure 2.

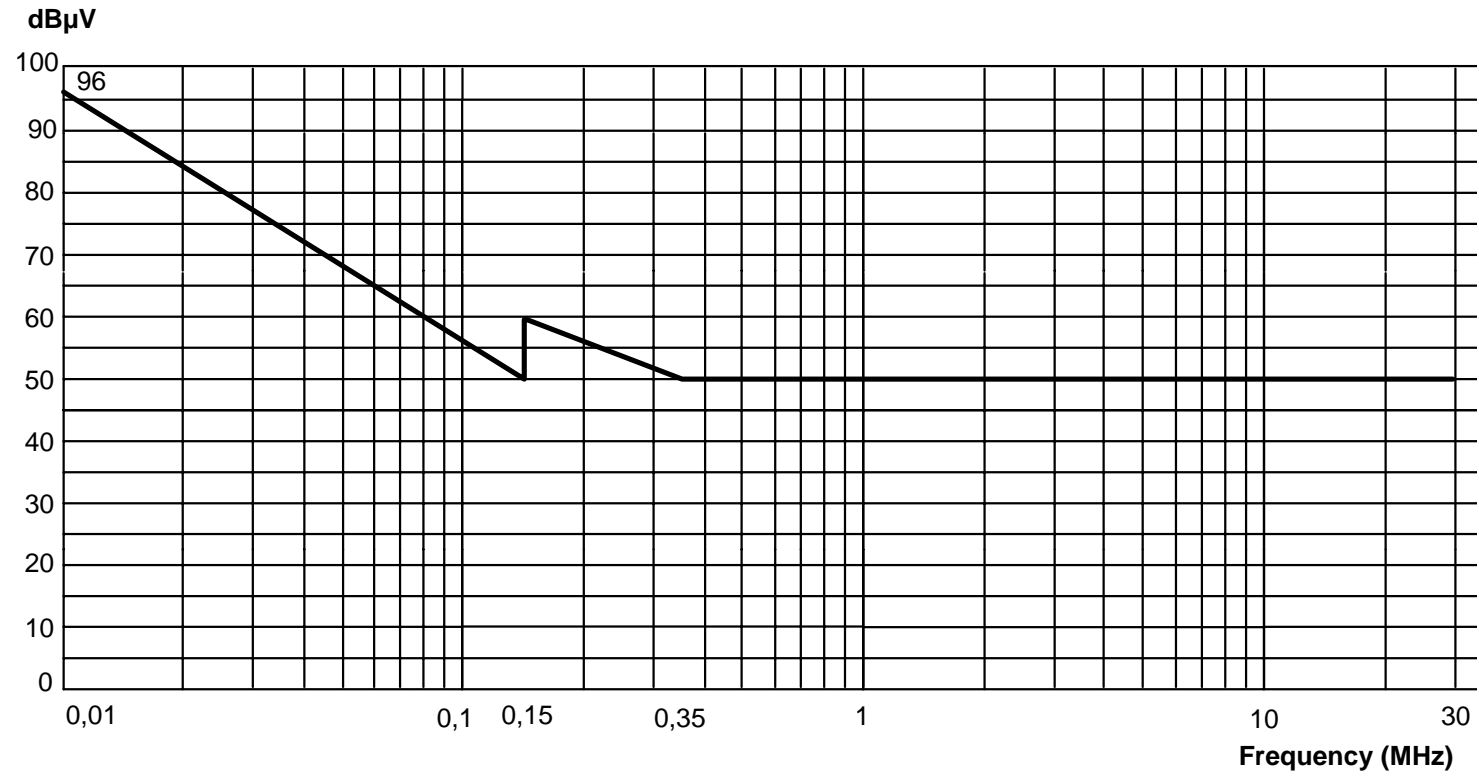


Figure 2: Maximum level of conducted spurious voltage into the mains



## 8.3 Radiated spurious emissions of the enclosure port of the radio equipment

### 8.3.1 Definition

This test assesses the ability of the EUT to limit unwanted (spurious) emissions from the enclosure of the radio equipment in the frequency range 30 MHz to 2 GHz.

### 8.3.2 Method of Measurement

The test method shall be in accordance with ETS 300 113 [11].

The receiver antenna connector shall be connected to an artificial antenna, as defined in subclause 3.1.

The tests shall be carried out on a test site defined in annex A of ETS 300 113 [11].

### 8.3.3 Limits

The power of any spurious radiation in the frequency range 30 MHz to 2 GHz shall not exceed 2 nW.

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## 9 Test methods and levels for immunity tests

The individual tests called up in table 2 (subclause 7.2) shall be performed in accordance with the basic standard specified in each case. Any deviations from this principle are elaborated in the text.

The tests shall be performed on the EUT when receiving the normal test signal in accordance with subclause 4.1.2.2 a).

The applicability of tests to specific classes of equipment is elaborated in table 2.

### 9.1 Radio frequency electromagnetic field (80 MHz to 1 000 MHz)

This test shall be performed on a representative configuration of the EUT.

#### 9.1.1 Definition

This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic field disturbance at the enclosure.

#### 9.1.2 Test method

The test method shall be in accordance with EN 61000-4-3 [7].

The RF-test level shall be 10 V/m swept over the frequency range 80 MHz to 1 GHz. The test signal shall be amplitude modulated with 400 Hz and a modulation depth of 80 %.

For narrowband responses, see subclause 4.1.2.5.

#### 9.1.3 Performance criteria

During the test the EUT shall meet the requirements of the performance check (subclause 6.5).

Performance criterion A (subclause 6.2) shall apply.

## 9.2 Electrostatic discharge (ESD)

This test shall be performed on a representative configuration of the EUT.

### 9.2.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge.

### 9.2.2 Test method

The test generator, "test set-up" and "test procedure" shall be in accordance with EN 61000-4-2 [3].

The test levels shall be  $\pm 2$  and  $\pm 4$  kV contact discharge, and  $\pm 2$ ,  $\pm 4$  and  $\pm 8$  kV air discharge.

Electrostatic discharges shall be applied to all exposed surfaces of the EUT except where the user documentation specifically indicates a requirement for appropriate protective measures.

### 9.2.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

## 9.3 Fast transient, differential and common mode

### 9.3.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of fast transients on the power, signal and control ports.

### 9.3.2 Test method

The test method shall be in accordance with EN 61000-4-4 [4].

This test shall be performed on AC power ports.

This test shall additionally be performed on signal and control ports and DC mains power ports (DC common mode only) when connected to cables which may be longer than 3 m.

Where this test is not carried out on any port because the manufacturer user documentation states that it is not intended to be used with cables longer than 3 m, a list of ports which were not tested for this reason shall be included in the test report.

A test generator complying with subclause 6.1.1 of EN 61000-4-4 [4] shall be used. Application of the fast transient signal shall be by a coupling/decoupling network complying with subclause 6.2 of EN 61000-4-4 [4] for AC/DC power lines and a capacitive coupling for signal and control lines clamp complying with subclause 6.6.3 of EN 61000-4-4 [4].

The test level shall be 2 kV. The test voltage shall be applied as a 15 ms burst every 300 ms for the duration of 3 minutes for each positive and negative polarity of the test voltage.

### 9.3.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

## 9.4 Conducted disturbances induced by RF-fields in the frequency range 150 kHz to 80 MHz

It is recognized that tests down to a frequency of 10 kHz (as called for in EN 60945 [10]) are an important requirement, however at this time there are no practical test methods available, hence here the lower frequency limit is set to 150 kHz.

This test shall be performed on the AC power input ports.

This test shall be performed on signal and control ports and the DC power ports of the EUT connected to cables which may be longer than 3 m.

Where this test is not carried out on any port because the manufacturer user documentation states that it is not intended to be used with cables longer than 3 m, a list of ports which were not tested for this reason shall be included in the test report.

The receiver frequency exclusion band shall be applied, see subclause 4.1.2.4.

### 9.4.1 Definition

This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic disturbance.

### 9.4.2 Test method

The EUT shall be subject to the test corresponding to EN 61000-4-6 [6].

A test generator complying with subclause 6.1 of EN 61000-4-6 [6] shall be used. The induction of the disturbances to power supply lines shall be by a coupling/decoupling network complying with subclause 6.2.2.1 of EN 61000-4-6 [6] and to input/output and control lines by direct injection as described in subclause 6.2.1 of EN 61000-4-6 [6].

The test level shall be 3 V rms swept over the frequency range of 150 kHz to 80 MHz. The modulation shall be Amplitude Modulation (AM) at a frequency of 400 Hz to a depth of 80 %.

Additionally a test shall be performed with a test level of 10 V rms at the following frequencies:

- 2 MHz;
- 3 MHz;
- 4 MHz;
- 6,2 MHz;
- 8,2 MHz;
- 12,2 MHz;
- 16,5 MHz;
- 18,8 MHz;
- 22 MHz; and
- 25 MHz.

The test shall be performed with the EUT in receive mode of operation. A receiver input level of 40 dBμV shall be used during the test.

For narrowband responses, see subclause 4.1.2.5.

### 9.4.3 Performance criteria

During the test the EUT shall meet the requirements of the performance check (subclause 6.5).

Performance criterion A (subclause 6.2) shall apply.

## 9.5 Power supply short term variations

### 9.5.1 Definition

This test assesses the ability of the EUT to operate as intended when being subjected to power supply short term variations present on the AC power input ports.

### 9.5.2 Test method

The test method shall be in accordance with EN 60945 [10]. The EUT shall be subject to the following power supply variations relative to the nominal value once per minute for the duration of 10 minutes each:

- a) test voltage = nominal voltage + (20 V  $\pm$  1 %) deviation, duration 1,5 s  $\pm$  0,2 s;  
test frequency = nominal frequency + (10 Hz  $\pm$  0,5 %) deviation, duration 5 s  $\pm$  0,5 s, superimposed;
- b) test voltage = nominal voltage - (20 V  $\pm$  1 %) deviation, duration 1,5 s  $\pm$  0,2 s;  
test frequency = nominal frequency - (10 Hz  $\pm$  0,5 %) deviation, duration 5 s  $\pm$  0,5 s, superimposed.

Voltage and frequency variation raise and decay times are 0,2 s  $\pm$  0,1 s (at 10 % and 90 %).

### 9.5.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

## 9.6 Power supply failure

### 9.6.1 Definition

This test assesses the ability of the EUT to operate as intended after being subjected to short breaks in the power supply due to power supply change over or breaker dropout. This test is not applicable to EUT intended for operation from battery power sources only or fitted with or connected to back-up batteries. It covers the break allowed by the IMO SOLAS Convention for changeover between ships main and emergency power supplies.

### 9.6.2 Test method

The EUT shall be subjected to 3 breaks in the power supply of a duration of 60 s each.

The relevant performance check shall be performed after each break.

### 9.6.3 Performance criteria

Performance criterion C (subclause 6.4) shall apply.

After each break the EUT shall meet the requirements of the performance check (subclause 6.5).

## 9.7 Surge

These tests shall be performed on AC power input ports.

These tests shall be performed on a representative configuration of the EUT and ancillary equipment as appropriate.

### 9.7.1 Definition

These tests assess the ability of the EUT and ancillary equipment to operate as intended in the event of surges on the AC power input ports.

### 9.7.2 Test method

The test method shall be in accordance with EN 61000-4-5 [5].

A combination wave (hybrid) generator complying with subclause 6.1 of EN 61000-4-5 [5] in combination with any coupling/decoupling network complying with subclause 6.3 of EN 61000-4-5 [5] shall be used.

The test voltage shall be 0,5 kV line-to-line (differential mode) and 1 kV line-to-ground (common mode). The test voltage shall be applied with a repetition rate of 6 pulses/minutes for a duration of 3 minutes for each polarity of the test voltage.

### 9.7.3 Performance criteria

Performance criterion B (subclause 6.3) shall apply.

After the test the EUT shall meet the requirements of the performance check (subclause 6.5).

## Annex A (normative):

### Subclauses of the present document relevant for compliance with the essential requirements of EC Council Directives

**Table A.1: Subclauses of the present document relevant for compliance with the essential requirements of EC Council Directives**

Clause/subclause and title		Corresponding article of Council Directive 89/336/EEC [8]	Qualifying remarks
8.1	Radiated emissions	4(a)	
8.2	Power ports	4(a)	
8.3	Radiated spurious emissions of the enclosure port of the radio equipment	4(a)	
9.1	Radio frequency electromagnetic field (80 MHz to 1 000 MHz)	4(b)	
9.2	Electrostatic discharge (ESD)	4(b)	
9.3	Fast transient, differential and common mode	4(b)	
9.4	Conducted disturbances induced by RF-fields in the frequency range 150 kHz to 80 MHz	4(b)	
9.5	Power supply short term variations	4(b)	
9.6	Power supply failure	4(b)	Relates to IMO SOLAS convention
9.7	Surge	4(b)	

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## History

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