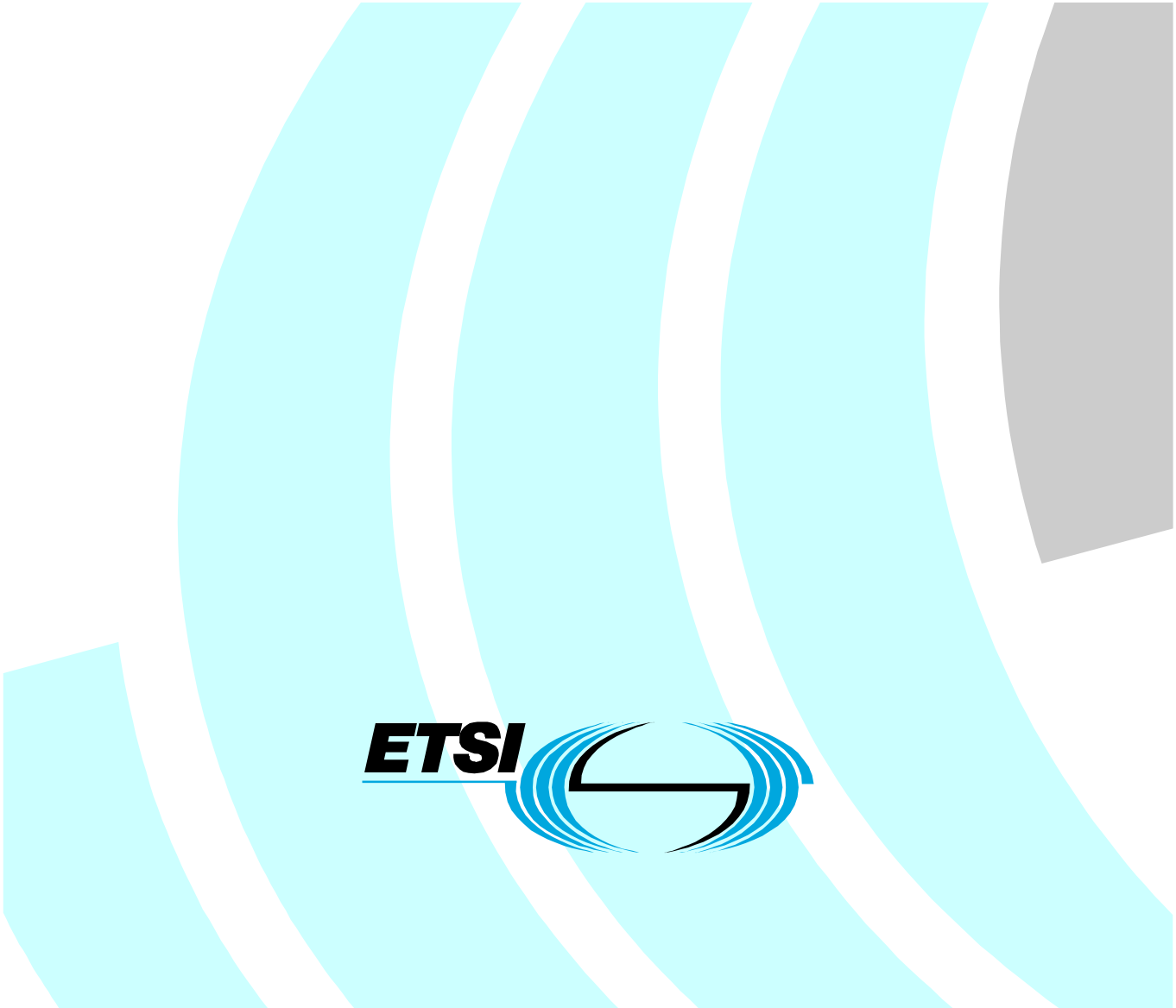
ETSI EN 300 373-3 V1.1.1 (2004-01)

Candidate Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Maritime mobile transmitters and receivers for use in the MF and HF bands; Part 3: Harmonized EN covering essential requirements under article 3.3(e) of the R&TTE Directive



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Contents

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Foreword

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

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (as amended) [12] laying down a procedure for the provision of information in the field of technical standards and regulations and following the Commission Decision 2000/638/EC of 22 September 2000 (see bibliography).

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Directive 1999/5/EC [1] of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

The present document is part 3 of a multi-part deliverable covering Maritime mobile transmitters and receivers for use in the MF and HF bands, as identified below:

Part 1: "Technical characteristics and methods of measurement";

Part 2: "Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive";

Part 3: "Harmonized EN covering essential requirements under article 3.3(e) of the R&TTE Directive".

Technical specifications relevant to Directive 1999/5/EC [1] are given in annex A.

National transposition dates	
Date of adoption of this EN:	26 December 2003
Date of latest announcement of this EN (doa):	31 March 2004
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 September 2004
Date of withdrawal of any conflicting National Standard (dow):	30 September 2005

Introduction

The present document is part of a set of standards designed to fit in a modular structure to cover all radio and telecommunications terminal equipment under the R&TTE Directive [1]. Each standard is a module in the structure. The modular structure is shown in figure 1.

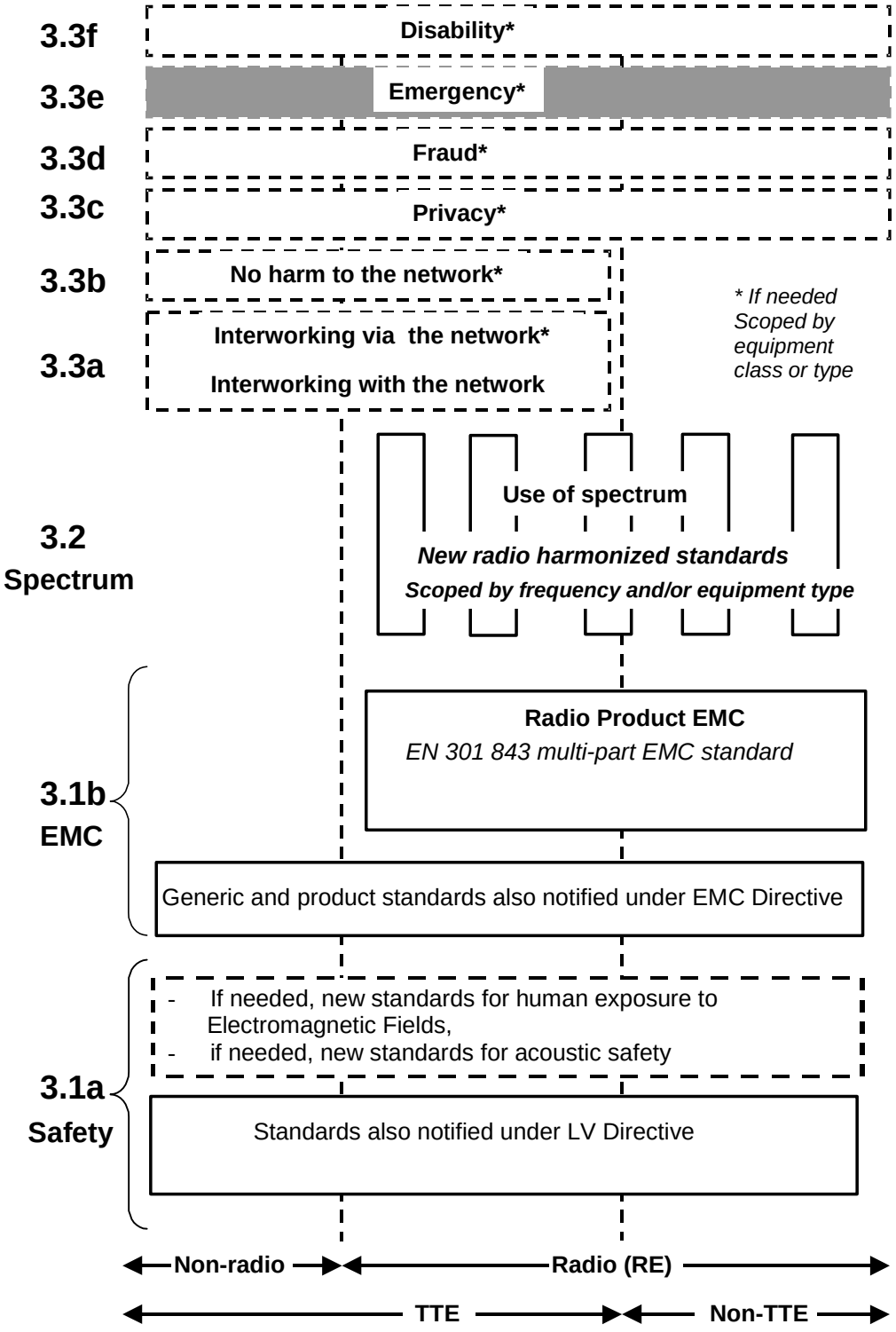


Figure 1: Modular structure for the various standards used under the R&TTE Directive [1]

The left hand edge of the figure 1 shows the different clauses of article 3 of the R&TTE Directive [1].

For article 3.3 various horizontal boxes are shown. Dotted lines indicate that at the time of publication of the present document essential requirements in these areas have to be adopted by the Commission. If such essential requirements are adopted, and as far and as long as they are applicable, they will justify individual standards whose scope is likely to be specified by function or interface type.

The vertical boxes show the standards under article 3.2 for the use of the radio spectrum by radio equipment. The scopes of these standards are specified either by frequency (normally in the case where frequency bands are harmonized) or by radio equipment type.

For article 3.1b the diagram shows EN 301 843 (see bibliography), the multi-part product EMC standard for radio used under the EMC Directive [2].

For article 3.1a the diagram shows the existing safety standards currently used under the LV Directive [3] and new standards covering human exposure to electromagnetic fields. New standards covering acoustic safety may also be required.

The bottom of figure 1 shows the relationship of the standards to radio equipment and telecommunications terminal equipment. A particular equipment may be radio equipment, telecommunications terminal equipment or both. A radio spectrum standard will apply if it is radio equipment. An article 3.3 standard will apply as well only if the relevant essential requirement under the R&TTE Directive [1] is adopted by the Commission and if the equipment in question is covered by the scope of the corresponding standard. Thus, depending on the nature of the equipment, the essential requirements under the R&TTE Directive [1] may be covered in a set of standards.

The modularity principle has been taken because:

- it minimizes the number of standards needed. Because equipment may, in fact, have multiple interfaces and functions it is not practicable to produce a single standard for each possible combination of functions that may occur in an equipment;
- it provides scope for standards to be added:
  - under article 3.2 when new frequency bands are agreed; or
  - under article 3.3 should the Commission take the necessary decisions without requiring alteration of standards that are already published;
- it clarifies, simplifies and promotes the usage of Harmonized Standards as the relevant means of conformity assessment.

1 Scope

The present document applies to radio transmitters and receivers, for use on vessels operating in either the Medium Frequency (MF) only or in the Medium and High Frequency (MF/HF) bands allocated in the International Telecommunications Union (ITU) Radio Regulations [4], to the Maritime Mobile Service (MMS).

The present document refers to equipment for one or more of the following:

- Single SideBand (SSB) modulation for telephony transmission and reception (J3E);
- Frequency Shift Keying (FSK) or SSB modulation of a keyed sub-carrier to transmit and receive Digital Selective Calling (DSC) signals in accordance with ITU-R Recommendation M.493-10 [5].

The present document also refers to radio equipment, which is not integrated with the DSC encoder or decoder, but defines the interfaces with such equipment.

NOTE 1: The requirements for integrated equipment may be found in other relevant EN/ETSs.

The present document is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive) article 3.3 e), which states that radio equipment within the scope of the present document shall be so constructed that: "it supports certain features ensuring access to emergency services".

The requirements in the present document are applicable to receivers for operating on all frequencies in the bands 1 605 kHz to 4 000 kHz or 1 605 kHz to 27,5 MHz as allocated in the ITU Radio Regulations [4], to the MMS.

Other spot frequency receivers should meet all the requirements of the present document and other relevant standards as applicable for the frequencies and modes provided.

If the equipment, or parts of it, are designed in such a manner that they can be used for other categories of maritime radiocommunication (e.g. Morse telegraphy or NBDP - ETS 300 067 [6]), those parts of the equipment should fulfil the relevant requirements of the appropriate standards for the service(s) in question e.g. ETS 300 067 [6].

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 R&TTE Directive [1] will apply to equipment within the scope of the present document.

NOTE 2: A list of such ENs is included on the web site http://www.newapproach.org.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[2] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive).

[3] Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).

[4] ITU Radio Regulations (2001).

[5] ITU-R Recommendation M.493-10: "Digital selective-calling system for use in the maritime mobile service".

[6] ETSI ETS 300 067: "Radio Equipment and Systems (RES); Radiotelex equipment operating in the maritime MF/HF service; Technical Characteristics and methods of measurement".

[7] ETSI EN 300 373-2 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Maritime mobile transmitters and receivers for use in the MF and HF bands; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive".

[8] IEC 61162-1 (2000): "Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners".

[9] ITU-T Recommendation E.161 (2001): "Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network".

[10] ISO 3791 (1976): "Office machines and data processing equipment - Keyboard layouts for numeric applications".

[11] ETSI TR 100 028: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[12] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

[13] ETSI EN 300 019-1-6: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-6: Classification of environmental conditions; Ship environments".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the R&TTE Directive [1] and the following apply:

assigned frequency: centre of the frequency band assigned to a station

carrier frequency: frequency to which the transmitter or receiver is tuned

environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

standard output power: (of the receiver) is defined as:

a) 1 mW for earphone reception;

b) 500 mW for loudspeaker reception;

c) 0 dBm into 600 Ω for the audio line outputs;

measured across a resistor equal to the nominal value of the load impedance as declared by the manufacturer

rated output power: (of the receiver) rated output power of the receiver is the output power of the receiver as declared by the manufacturer which should be at least 2 W, whilst the total harmonic distortion conforms to the requirements of the spurious response rejection ratio limits, see EN 300 373-2 [7], clause 4.2.10.2

3.2 Symbols

For the purposes of the present document, the symbols given in the ITU Radio Regulations [4] and the following apply:

F1B	frequency modulation, single channel containing quantized or digital information without the use of a modulating sub-carrier, telegraphy for automatic reception
J2B	SSB, suppressed carrier, single channel containing quantized or digital information with the use of a modulating sub-carrier, telegraphy for automatic reception
J3E	SSB, suppressed carrier, single channel containing analogue information, telephony

3.3 Abbreviations

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

AGC	Automatic Gain Control
DSC	Digital Selective Calling
EMC	ElectroMagnetic Compatibility
emf	electromotive force
EUT	Equipment Under Test
FSI	Frequency Set Information
FSK	Frequency Shift Keying
IEC	International Electrotechnical Committee
ISO	International Standards Organization
ITU	International Telecommunications Union
LV	Low Voltage
MF	Medium Frequency
MF/HF	Medium and High Frequency
MMS	Maritime Mobile Service
MMSI	Maritime Mobile Service Identity
NBDP	Narrow Band Direct Printing telegraphy
PEP	Peak Envelope Power
R&TTE	Radio and Telecommunications Terminal Equipment
RMS	Root Mean Square
SNR	Signal-to-Noise Ratio
SSB	Single Side Band

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be determined by the environmental class of the equipment. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the required operational environmental profile.

4.2 General, operational and technical requirements

4.2.1 General

There are no essential test suites for the requirements in clause 4.2. The availability of the specified controls shall be verified by visual inspection.

4.2.2 General requirements

4.2.2.1 Composition

4.2.2.1.1 Audio frequencies interfaces

The following inputs and outputs applicable to the type of equipment shall be provided:

a) transmitters:

- SSB Telephony:
  - 600 Ω earth free audio input;
  - microphone input;
- DSC with analogue interfaces:
  - 600 Ω earth free audio input;
- DSC with digital interfaces:
  - IEC 61162-1 [8] input.

  The logic level and the appropriate functions shall comply with IEC 61162-1 [8]. The B-state shall be logic "0", and the Y-state shall be logic "1".

b) receivers:

- SSB Telephony:
  - 600 Ω earth free audio output;
  - earphone output;
  - speaker output;
- DSC with analogue interfaces:
  - 600 Ω earth free audio output;
- DSC with digital interfaces:
  - IEC 61162-1 [8] input.

  The logic level and the appropriate functions shall comply with IEC 61162-1 [8]. The B-state shall be logic "0", and the Y-state shall be logic "1".

c) control(s):

- if a control interface is provided to the equipment it shall meet IEC 61162-1 [8].

The interface for control shall comply with IEC 61162-1 [8].

The protocols shall at least comply with Frequency Set Information (FSI) (see annex A).

Transmitter key input interface shall be a 2-wire circuit, closure to transmit with a maximum open circuit voltage of 50 V and a maximum closed circuit current of 100 mA.

Connectors used should be readily available commercially. Manufacturers shall provide identification of the actual connections used.

4.2.2.1.2 Digital input panels

Where a digital input panel with the digits "0" to "9" is provided, the digits shall be arranged to conform with ITU-T Recommendation E.161 [9]. However, where an alphanumeric keyboard layout is provided, the digits "0" to "9" may, alternatively, be arranged to conform with ISO 3791 [10].

4.2.2.2 Construction

The attention of the manufacturer is drawn to EN 60945 (see bibliography) which offers guidelines on the construction and ergonomic details for equipment intended to be used on board vessels.

All controls shall be of sufficient size to enable the usual control functions to be easily performed and the number of controls should be the minimum necessary for simple and satisfactory operation.

Adequately detailed operating instructions shall be provided with the equipment.

The equipment shall be capable of operating on single-frequency and two-frequency channels with manual control (simplex).

4.2.2.3 Controls and indicators

4.2.2.3.1 General

All controls shall be easily identified from the position at which the operator operates the equipment.

The number of operational controls, their design and manner of functioning, location, arrangement and size should provide for simple, quick and efficient operation. Controls which are not necessary for normal operation shall not be readily accessible to the operator.

The controls should be arranged in a manner which minimizes the risk of inadvertent operation.

For transmitters it shall be possible to change the transmitter from any class of emission to another for which it is designed to operate by means of not more than one control.

For receivers the class of emission shall be selectable by not more than one control.

Facilities shall be provided to enable the loudspeaker to be switched off when reception is by headphones or telephone handset. Automatic facilities shall be provided to turn off the loudspeaker during duplex operation.

If a device is provided in the receiver to reduce the effects of impulsive noise, a switch shall be provided to disable its function.

4.2.2.3.2 Illumination

Equipment intended to be installed on the navigating bridge of a ship shall be provided with adequate illumination to enable identification of controls and facilitate reading of indicators at all times. Means shall be provided for reducing continuously, to extinction, the output of any light source on the equipment which is capable of interfering with navigation.

All adjustments and controls necessary for switching the transmitter and receiver to operate on the distress and safety channels covered by the equipment shall be clearly marked in order that this operation can be easily performed.

If the accessible controls are located on a separate control panel and if there are two or more control panels, one of the control panels shall have priority over the others. If there are two or more control panels, when any control panel is in use, this shall be clearly indicated on all of the other control panels.

4.2.2.4 Labelling

4.2.2.4.1 General

All controls, instruments, indicators and terminals shall be clearly labelled.

The compass safe distance shall be stated on the equipment or in the user document.

4.2.2.4.2 Distress frequencies

The distress frequencies shown in table 1, which are applicable to the equipment, shall be clearly indicated, either on the front panel of the equipment or on an instruction label supplied with the equipment.

Table 1: Distress frequencies

DSC (kHz)	Telephony (kHz)	Telex (kHz)
2 187,5	2 182	2 174,5
4 207,5	4 125	4 177,5
6 312	6 215	6 268
8 414,5	8 291	8 376,5
12 577	12 290	12 520
16 804,5	16 420	16 695
NOTE: The above DSC and telex frequencies are assigned frequencies whereas the carrier frequency is indicated for telephony.		

In addition, manual controls necessary for the tuning of the equipment to the relevant frequencies in table 1, and their settings, shall be clearly indicated.

4.2.2.5 Protection against mishandling

Provision shall be made for protecting the equipment from damage if the power supply is subject to transient voltage changes, from damage due to the accidental reversal of the polarity of the power supply, and from the effects of excessive voltage.

The information in any volatile memory device shall be protected from interruptions in the power supply up to 60 s duration. The information in programmable memory devices and the vessel's identity and information inherent to the DSC process shall be stored in non-volatile memory devices.

The information in user programmable memory devices shall be protected from interruptions in the power supply of at least 10 hours duration.

4.2.3 Operational requirements

4.2.3.1 Frequency bands

The equipment shall be capable of operating in either the MF or in the MF/HF bands as defined in clauses 4.2.3.1.1 and 4.2.3.1.2.

4.2.3.1.1 MF band

The equipment shall provide for the transmission and/or reception in the appropriate frequency bands between 1 605 kHz and 4 000 kHz allocated in the ITU Radio Regulations [4] to the MMS.

4.2.3.1.2 HF bands

The equipment shall provide for the transmission and/or reception in the appropriate frequency bands between 4 MHz and 27,5 MHz allocated in the ITU Radio Regulations [4] to the MMS.

4.2.3.2 Classes of emission

The equipment shall provide for the transmission and/or reception of signals using the classes of emission defined below, as appropriate to the equipment:

J3E SSB telephony, with the carrier suppressed at least 40 dB below peak envelope power;

F1B FSK suitable for DSC with a frequency shift of ±85 Hz. Alternatively class of modulation J2B can be used with a 1 700 Hz sub-carrier. In this case the equipment shall be tuned to a carrier frequency 1 700 Hz below the assigned frequency.

The receiver may also provide for the reception of signals of other classes of emission.

4.2.4 Warming up period

4.2.4.1 Time

The equipment shall be operational and shall meet the requirements of the present document one minute after switching on, except as provided in clause 4.2.4.2.

4.2.4.2 Heaters

If the equipment includes parts which require to be heated in order to operate correctly, (e.g. crystal ovens), then a warming-up period of 30 mins from the instant of application of power to those parts shall be allowed, after which the requirements of the present document shall be met.

4.2.4.3 Heating circuits

Where clause 4.2.4.2 is applicable, the power supplies to the heating circuits shall be arranged so that they can remain operative when other supplies to the equipment or within the equipment are switched off. If a special switch for these circuits is provided on the equipment, the function of the switch shall be clearly indicated and the operating instructions shall state that the circuit should normally be left connected to the power supply source.

A visual indication that power is connected to such circuits shall be provided.

4.2.4.4 Delay

If it is necessary to delay the application of power to any part of the transmitter after switching on, such delay shall be provided automatically.

4.2.5 Technical requirements

4.2.5.1 Distress controls

All adjustments and controls necessary for switching the transmitter and receiver to operate on the distress and safety channels covered by the equipment shall be clearly marked in order that this operation can be easily performed.

4.2.5.2 Telephony transmit control

In single or two-frequency simplex operating mode, switching from the receiving condition to the transmitting condition and vice versa, shall be accomplished by a single control. This control should be located on the microphone or telephone handset and when at rest shall leave the equipment in the receive condition.

4.2.5.3 Misuse

The equipment shall be so designed that misuse of the controls cannot cause damage to the equipment.

4.2.5.4 Control panel priority

If the accessible controls are located on a separate control panel and if there are two or more control panels, one of the control panels shall have priority over the others. If there are two or more control panels, when any control panel is in use, this shall be clearly indicated on all of the other control panels.

4.2.5.5 Manual gain control and Automatic Gain Control (AGC)

Telephony receivers shall be provided with a manual control of audio frequency gain and with an AGC of the radio frequency and/or intermediate frequency capable of operation on the classes of emission specified in clause 4.2.3.2 and the frequency ranges specified in clause 4.2.3.1.

4.2.5.6 Output indication

The transmitter shall incorporate an indicator of the antenna current and/or output power.

4.3 Environmental requirements

4.3.1 Vibration test

4.3.1.1 Definition

This test determines the ability of equipment to withstand vibration without resulting in mechanical weakness or degradation in performance.

4.3.1.2 Requirement

The limits under extreme conditions specified in clause 5.3.1.3 shall be fulfilled.

There shall be no harmful deterioration of the equipment visible to the naked eye.

4.3.1.3 Conformance

Environmental tests as defined within clause 5.3.1 shall be carried out.

4.3.2 Temperature tests

4.3.2.1 Definition

The immunity against the effects of temperature is the ability of the equipment to maintain the specified mechanical and electrical performance after the following tests have been carried out. The maximum rate of raising or reducing the temperature of the chamber in which the equipment is being tested shall be 1°C/min.

4.3.2.2 Dry heat

4.3.2.2.1 Definition

This test determines the ability of equipment to be operated at high ambient temperatures and operate through temperature changes.

4.3.2.2.2 Requirement

4.3.2.2.2.1 Internally mounted equipment

The limits under extreme conditions specified in clause 5.3.1.3 shall be fulfilled.

4.3.2.2.2.2 Externally mounted equipment

The limits under extreme conditions specified in clause 5.3.1.3 shall be fulfilled.

4.3.2.2.3 Conformance

Environmental tests as defined within clause 5.3.1 shall be carried out.

4.3.2.3 Damp heat

4.3.2.3.1 Definition

This test determines the ability of equipment to be operated under conditions of high humidity.

4.3.2.3.2 Requirement

The limits under extreme conditions specified in clause 5.3.1.3 shall be fulfilled.

4.3.2.3.3 Conformance

Environmental tests as defined within clause 5.3.1 shall be carried out.

4.3.2.4 Low temperature cycle

4.3.2.4.1 Definition

This test determines the ability of equipment to be operated at low temperatures. It also allows equipment to demonstrate an ability to start up at low ambient temperatures.

4.3.2.4.2 Requirement

4.3.2.4.2.1 Internally mounted equipment

The limits under extreme conditions specified in clause 5.3.1.3 shall be fulfilled.

4.3.2.4.2.2 Externally mounted equipment

The limits under extreme conditions specified in clause 5.3.1.3 shall be fulfilled.

4.3.2.4.3 Conformance

Environmental tests as defined within clause 5.3.1 shall be carried out.

4.3.3 Corrosion test

4.3.3.1 Definition

This test determines the ability of equipment to withstand and operate in a corrosive environment.

4.3.3.2 Requirement

There shall be no undue deterioration or corrosion of the metal parts, finishes, material or component parts visible to the naked eye.

In the case of hermetically sealed equipment there shall be no evidence of moisture penetration.

The limits under normal conditions specified in clause 5.3.1.3 shall be fulfilled.

4.3.3.3 Conformance

Environmental tests as defined within clause 5.3.1 shall be carried out.

4.3.4 Rain test

4.3.4.1 Definition

This test determines the ability of equipment to withstand and operate in a wet environment.

4.3.4.2 Requirement

The limits under normal conditions specified in clause 5.3.1.3 shall be fulfilled.

There shall be no evidence of ingress of water visible to the naked eye.

4.3.4.3 Conformance

Environmental tests as defined within clause 5.3.1 shall be carried out.

4.4 Conformance requirements

4.4.1 Unwanted frequency modulation

4.4.1.1 Definition

Unwanted frequency modulation is the deviation of output frequency of the transmitter which may occur due to a number of causes but especially when the complete equipment is vibrated over a specified range of frequencies and amplitudes.

4.4.1.2 Limit

The frequency peak deviation shall not exceed ±5 Hz.

4.4.1.3 Conformance

Conformance tests as described in clause 5.3.2.1 shall be carried out.

4.4.2 Sensitivity of the microphone and the 600 Ω line inputs for SSB telephony

4.4.2.1 Definition

This test shows the capability of the transmitter to produce its full output power, and be fully modulated, when an acoustic tone signal corresponding to the normal mean speech level is applied to the microphone supplied with the equipment or when a normal audio line signal level is applied to the 600 Ω line input.

4.4.2.2 Limits

The output power level shall be within -3 dB and -9 dB relative to the maximum output power as measured in EN 300 373-2 [7], clause 5.3.2.

4.4.2.3 Conformance

Conformance tests as described in clause 5.3.2.2 shall be carried out.

4.4.3 Automatic level control and/or limiter for SSB telephony

4.4.3.1 Definition

This test shows the capability of the equipment to produce an output power, proportional with the modulating input power.

4.4.3.2 Limits

The graph shall lie within the limits given in figure 2.

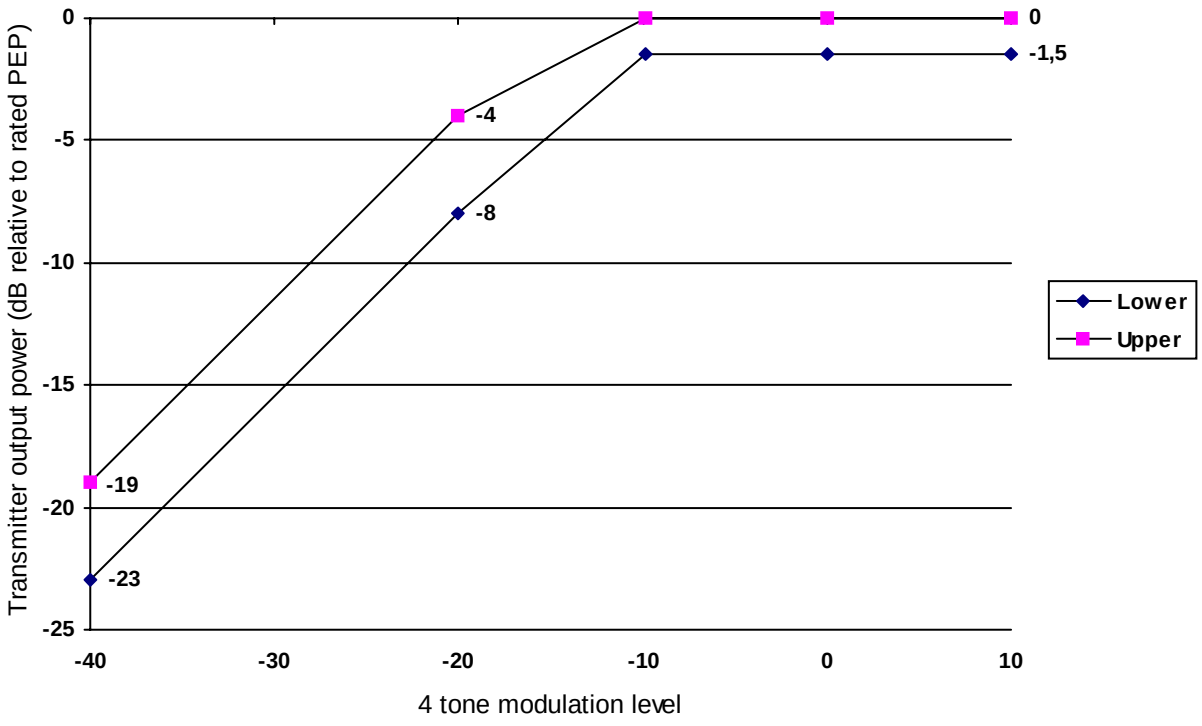


Figure 2: Limits of telephony level control

4.4.3.3 Conformance

Conformance tests as described in clause 5.3.2.3 shall be carried out.

4.4.4 Audio frequency response of SSB telephony

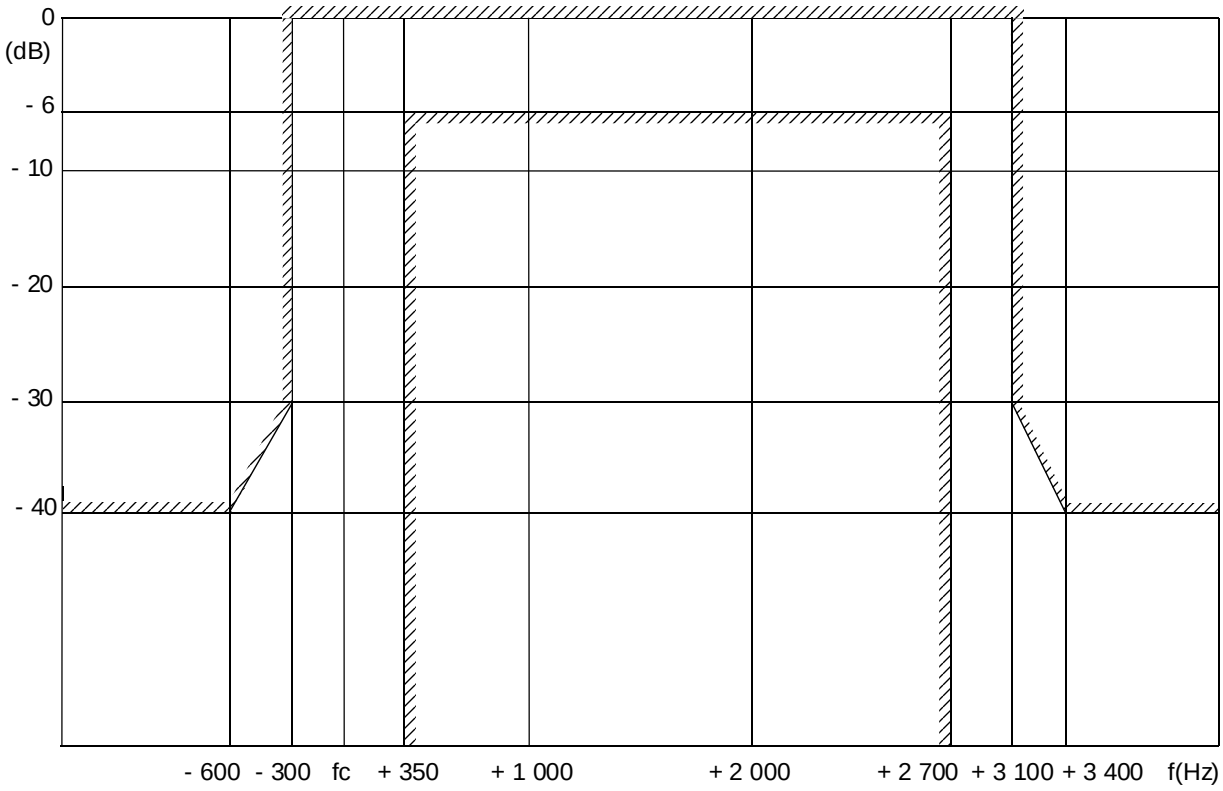
4.4.4.1 Definition

The audio frequency response is the variation of the output power as a function of the modulation audio frequency.

4.4.4.2 Limits

The graph shown in figure 3 shall be adjusted so that the peak touches the 0 dB line.

The audio frequency response characteristic and its image shall lie between the hatched areas shown in figure 3.



Audio frequency response

Figure 3: Limits of audio frequency response

4.4.4.3 Conformance

Conformance tests as described in clause 5.3.2.4 shall be carried out.

4.4.5 Residual hum and noise power for telephony

4.4.5.1 Definition

The residual hum and noise power is that power supplied by the transmitter to the artificial antenna when the modulation input signals are interrupted.

4.4.5.2 Limits

The total residual hum and noise power excluding the carrier shall be at least 40 dB below the peak envelope power.

4.4.5.3 Conformance

Conformance tests as described in clause 5.3.2.5 shall be carried out.

4.4.6 Residual frequency modulation on DSC

4.4.6.1 Definition

The residual frequency modulation of the transmitter is defined as the ratio in dB of the demodulated B or Y signal relative to the demodulated dot pattern.

4.4.6.2 Limits

The residual frequency modulation shall not be greater than -26 dB.

4.4.6.3 Conformance

Conformance tests as described in clause 5.3.2.6 shall be carried out.

4.4.7 Continuous operation on telephony

4.4.7.1 Definition

Continuous operation of the transmitter is the ability to produce full rated RF output power without interruption for a specified time.

4.4.7.2 Limits

The output power shall not vary by more than ±1,5 dB from the rated output power. The limits of EN 300 373-2 [7], clause 4.2.2 shall not be exceeded.

4.4.7.3 Conformance

Conformance tests as described in clause 5.3.2.7 shall be carried out.

4.4.8 Protection of transmitter

4.4.8.1 Definition

This represents the protection afforded to the transmitter against damage which may be caused by faults occurring in the ship's transmitting antenna.

4.4.8.2 Limits

This test shall not result in any damage to the transmitter. After removal of the short-circuit or open-circuit conditions, the transmitter shall be able to operate normally for all available modes.

4.4.8.3 Conformance

Conformance tests as described in clause 5.3.2.8 shall be carried out.

4.4.9 Receiver frequency error

4.4.9.1 Definition

The frequency error of the receiver is:

a) for SSB telephony:

- the absolute frequency error of the 1 000 Hz output frequency when the receiver is tuned to the carrier frequency using the input signal defined in clause 5.1.6.2.1;

b) for DSC with an analogue interface:

- the absolute frequency error of the 1 700 Hz output frequency when the receiver is tuned to the assigned frequency using input signal defined in clause 5.1.6.2.2.

4.4.9.2 Limits

The receiver frequency error shall be less than ±10 Hz, after the warming up period specified in clause 4.2.4.

4.4.9.3 Conformance

Conformance tests as described in clause 5.4.2 may be carried out.

4.4.10 Unwanted frequency modulation

4.4.10.1 Definition

Unwanted frequency modulation is the deviation of output frequency which may occur due to a number of causes but especially when the complete equipment is vibrated over a specified range of frequencies and amplitudes.

4.4.10.2 Limits

The frequency peak deviation shall not exceed ±5 Hz.

4.4.10.3 Conformance

Conformance tests as described in clause 5.4.3 may be carried out.

4.4.11 Pass band

4.4.11.1 Definition

The pass band measured at the output of the receiver is the frequency band in which the attenuation relative to peak response does not exceed 6 dB.

4.4.11.2 Limits

The audio frequency pass band shall exceed 350 Hz to 2 700 Hz.

4.4.11.3 Conformance

Conformance tests as described in clause 5.4.4 may be carried out.

4.4.12 Reciprocal mixing

4.4.12.1 Definition

Reciprocal mixing is the transfer of the noise sidebands of the receivers' local oscillator(s) to a wanted signal due to the presence of a large wanted or unwanted signal.

4.4.12.2 Limits

The reciprocal mixing level shall be not less than +100 dBµV.

4.4.12.3 Conformance

Conformance tests as described in clause 5.4.5 may be carried out.

4.4.13 Harmonic content in output

4.4.13.1 Definition

The harmonic content in the output of a telephony receiver is the total RMS voltage of all the individual harmonics of modulation frequencies, appearing at the receiver outputs as a result of non-linearity in the receiver. For purposes of test it is expressed as a percentage of the total RMS output voltage, when a single sinusoidal modulation is applied.

4.4.13.2 Limits

The harmonic content shall not exceed 10 % at rated output power and 5 % at standard output power.

4.4.13.3 Conformance

Conformance tests as described in clause 5.4.6 may be carried out.

4.4.14 Audio frequency intermodulation

4.4.14.1 Definition

Audio frequency intermodulation is a process by which signals are produced from two or more wanted signals simultaneously present in the demodulator and/or audio amplifier of a telephony receiver. It is expressed in terms of the ratio of the level of each intermodulation component relative to the level of one or two test signals of equal amplitude.

4.4.14.2 Limits

The value of any of the intermodulation components shall not exceed -25 dB relative to the output level of any one of the two wanted signals.

4.4.14.3 Conformance

Conformance tests as described in clause 5.4.7 may be carried out.

4.4.15 Internally generated spurious signals

4.4.15.1 Definition

Internally generated spurious signals are those signals that may appear in the output of a receiver due to mixing processes in the receiver system without any antenna input signal.

4.4.15.2 Limit

There shall be no internally generated spurious signals on any designated distress frequency and its associated guard bands. On all other channels where spurious occur, the level shall be less than 10 dB above the inherent noise level.

4.4.15.3 Conformance

Conformance tests as described in clause 5.4.8 may be carried out.

4.4.16 AGC efficiency

4.4.16.1 Definition

The AGC efficiency of the receiver is the ability to keep the change of audio output level within limits when the RF input voltage is varied over a specified range.

4.4.16.2 Limits

Under the test conditions specified in clause 5.4.9.1 the receiver shall be adjusted to give an output level 10 dB below the standard output power. The input level shall then be increased by 70 dB. The resulting increase in output power shall not exceed 10 dB.

4.4.16.3 Conformance

Conformance tests as described in clause 5.4.9 may be carried out.

4.4.17 AGC time constants (attack and recovery time)

4.4.17.1 Definitions

AGC attack time: the elapsed time from the instant at which the input-signal level is suddenly increased by a specified amount, until the instant at which the level of the output signal reaches and remains within ±2 dB of the subsequent steady-state value.

AGC recovery time: the elapsed time from the instant when the input-signal level is suddenly decreased by a specified amount, until the instant at which the output signal reaches and remains within ±2 dB of the subsequent steady-state value.

4.4.17.2 Limits

Attack time: 5 ms to 10 ms.

Recovery Time: 1 s to 4 s.

4.4.17.3 Conformance

Conformance tests as described in clause 5.4.10 may be carried out.

4.4.18 Protection of input circuits

4.4.18.1 Definition

The protection of the input circuits is the ability of the antenna input to stand large voltages for a specified time.

4.4.18.2 Limits

The receiver shall operate normally without further attention when the test signal is removed.

4.4.18.3 Conformance

Conformance tests as described in clause 5.4.11 may be carried out.

5 Testing for compliance with technical requirements

5.1 Test conditions, power supply and ambient temperatures

5.1.1 General

Conformance testing shall be carried out under normal test conditions and, where stated, under extreme test conditions.

When preparing test report forms for equipment tested in accordance with the present document, the point where the DC voltage is measured shall be specified (see clause 5.1.2).

5.1.2 Test power source

During conformance testing the equipment shall be supplied from a test power source, capable of producing normal and extreme test voltages as specified in clauses 5.1.3.2 and 5.1.4.2.

For the purposes of tests, the voltage of the power supply shall be measured at the input terminals of the equipment.

If the equipment is provided with a power cable permanently connected, the test voltage shall be that measured at the point of connection of the power cable to the equipment.

During tests, the test power source voltages shall be maintained within a tolerance of ±3 % relative to the voltage at the beginning of each test.

5.1.3 Normal test conditions

5.1.3.1 Normal temperature and humidity

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

- temperature: +15°C to +35°C;
- relative humidity: 20 % to 75 %.

5.1.3.2 Normal test power source

5.1.3.2.1 Mains voltage and frequency

The normal test voltage for equipment to be connected to the ac mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage or any one of the declared voltages for which the equipment was designed.

The frequency of the test power supply corresponding to the ac mains shall be 50 Hz ± 1 Hz.

5.1.3.2.2 Secondary battery power sources

Where the equipment is designed to operate from a battery, the normal test voltage shall be the nominal voltage of the battery (e.g. 12 V, 24 V etc.).

5.1.3.2.3 Other power sources

For operation from other power sources, the normal test voltage shall be as stated by the manufacturer.

5.1.4 Extreme test conditions

5.1.4.1 Extreme temperature tests

When testing under extreme conditions, the measurements shall be carried out at -15°C and +55°C for equipment intended for mounting below deck, and -25°C and +55°C for equipment intended for mounting above deck.

Before making measurements, the equipment shall have reached thermal balance in the test chamber. The equipment shall be switched off during the temperature stabilizing period, except the power supplies to the heating circuits. The sequence of measurements shall be chosen, and the humidity content in the test chamber shall be controlled so that excessive condensation does not occur.

5.1.4.2 Extreme values of test power source

5.1.4.2.1 Mains voltage and mains frequency

The extreme test voltages for equipment to be connected to an ac mains supply shall be the nominal mains voltage ± 10 %.

The frequency of the test power supply corresponding to the ac mains shall be 50 Hz ± 1 Hz.

5.1.4.2.2 Secondary battery power sources

When the equipment is intended for operation from a secondary battery power supply, the extreme test voltage shall be 1,3 and 0,9 times the nominal voltage of the battery (e.g. 12 V, 24 V etc.).

5.1.4.2.3 Other power sources

For equipment using other power sources, the extreme test voltages shall be as stated by the manufacturer.

5.1.5 Artificial antennas

5.1.5.1 Transmitters

For the purpose of conformance testing, the transmitter, at the output of the antenna matching device, shall meet the requirements of the present document when connected to the artificial antennas listed below:

- frequency range 1 605 kHz to 4 000 kHz:
  - the artificial antenna shall consist of a resistance of 10 Ω and a capacitance of 250 pF connected in series;
- frequency range 4 MHz to 27,5 MHz:
  - the artificial antenna shall consist of a resistance of 50 Ω.

These characteristics shall in no way imply that the transmitter shall only work with antennas having these characteristics.

5.1.5.2 Receivers

For the purpose of conformance testing, the receiver shall meet the requirements of the present document when connected to a test source, as described in clause 5.1.6.1.1, at the point at which the antenna is normally connected, having the following characteristics:

- the test signal shall be derived from a resistive source of 50 Ω except as permitted below:
  - in the frequency range 1 605 kHz to 4 000 kHz at the request of the manufacturer, an artificial antenna consisting of a 10 Ω resistor in series with a 250 pF capacitor may be used for frequencies below 4 MHz.

The arrangement used shall be stated in the test report.

This shall in no way imply that the receiver should operate satisfactorily only with antennas having these impedance characteristics.

5.1.6 Standard test signals

5.1.6.1 Test signals applied to the receiver input

5.1.6.1.1 Sources

Sources of test signals for application to the receiver input shall be connected through a network such that the impedance presented to the receiver input is equal to that of the artificial antennas specified in clause 5.1.5.2. This requirement shall be met irrespective of whether one, two or more test signals are applied to the receiver simultaneously. In the case of multiple test signals, steps shall be taken to prevent any undesirable effects due to interaction between the signals in the generators or other sources.

5.1.6.1.2 Levels

The levels of test input signals shall be expressed in terms of the emf which would exist at the output terminals of the source including the associated network referred to in clause 5.1.6.1.1.

5.1.6.2 Normal test signals

Except where otherwise stated, radio frequency test signals applied to the receiver input shall be as described in the following clauses.

5.1.6.2.1 Class of emission J3E

Unmodulated signal, 1 000 Hz (±0,1 Hz) above the carrier frequency to which the receiver is tuned.

5.1.6.2.2 Class of emission F1B

DSC with an analogue interface, unmodulated signal on the assigned frequency.

DSC with a digital interface, a signal on the assigned frequency, modulated as appropriate.

Frequency shift signal with ±85 Hz shift at 100 Bd with pseudo random bit pattern.

5.1.6.3 Choice of testing frequencies

Unless otherwise stated, tests shall be carried out at the distress frequency and one other frequency for that class of emission in each of the bands in which the equipment is designed to operate.

The frequencies used shall be stated in the test report.

5.1.7 Warming up period

5.1.7.1 Time

The equipment shall be operational and shall meet the requirements of the present document one minute after switching on, except as provided in clause 4.2.4.

5.1.7.2 Heaters

If the equipment includes parts which require to be heated in order to operate correctly, (e.g. crystal ovens), then a warming-up period of 30 mins from the instant of application of power to those parts shall be allowed, after which the requirements of the present document shall be met.

5.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 2.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 [11] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 2 is based on such expansion factors.

Table 2: Maximum measurement uncertainty

Parameter	Uncertainty
RF frequency	$\pm 1 \times 10^{-8}$
RF Power, PEP in 50 Ω	±1,5 dB
RF Power, PEP in 10 Ω/250 pF	±2,5 dB
Audio output power	±0,5 dB
Two signal measurement	±4 dB
Three signal measurement	±3 dB

5.3 Essential radio test suites

5.3.1 Environmental tests

5.3.1.1 Introduction

The equipment shall be capable of continuous operation under the conditions of various sea states, vibration, humidity and change of temperature likely to be experienced in a ship in which it is installed.

NOTE: Classification of environmental conditions may be found in EN 300 019-1-6 [13].

5.3.1.2 Procedure

Environmental tests shall be carried out before tests of the same equipment in respect to the other requirements of the present document are performed.

Unless otherwise stated, the equipment shall be connected to an electrical power source during the periods for which it is specified that electrical tests shall be carried out. These tests shall be performed using the normal test voltage.

During the environmental tests, the output of the transmitter may be reduced by 6 dB, but shall exceed 60 W PEP.

5.3.1.3 Performance check

For the purpose of the present document, the term "performance check" shall be taken to mean the following measurements and limits:

- for the transmitter:
  - frequency error:

    With the transmitter connected to an artificial antenna (see clause 5.1.5), the transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment and operated in J3E mode and shall be modulated with a signal of 1 000 Hz ± 0,1 Hz. The 1 000 Hz signal shall be subtracted from the measured frequency to get the transmitter frequency. The transmitter frequency shall be within ±10 Hz of the selected frequency.

  - output power:

    With the transmitter connected to an artificial antenna (see clause 5.1.5), the transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment and operated in J3E mode. The transmitter shall be modulated by a test signal consisting of two audio frequency tones, applied simultaneously to the microphone input, at frequencies of 1 100 Hz and 1 700 Hz. The level of the tones shall be adjusted so that they produce equal output power and it shall be possible to obtain an output power of greater than 60 W PEP.

- for the receiver:
  - maximum usable sensitivity.

    With the AGC operative, the receiver shall be adjusted to 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment and operated in J3E mode. A test signal as specified in clause 5.1.6.2.1 shall be applied. The level of the input signal shall be adjusted until the SINAD at the output of the receiver is 20 dB, and the output power is at least the standard output power (see clause 3.1). The level of the input signal shall be not greater than +22 dBµV at 2 182 kHz or not greater than +17dBuV at 8 291 kHz.

5.3.1.4 Vibration test

The equipment, complete with any shock absorbers which are part of it, shall be clamped to the vibration table by its normal means of support and in its normal attitude.

The equipment may be suspended to compensate for weight not capable of being withstood by the vibration table.

Provisions may be made to reduce or nullify any adverse effect on the equipment performance which may be caused by the presence of any electro-magnetic fields from the vibration table.

Taking at least 15 mins to cover each octave of frequency, the equipment shall be subjected to sinusoidal vertical vibration at all frequencies between:

- 2 Hz or 5 Hz and 13,2 Hz with an excursion of ±1 mm ± 10 %;
- 13,2 Hz and 100 Hz with a constant maximum acceleration of 7 m/s/s.

A resonance search shall be carried out during the vibration test. If any resonance of the EUT has Q greater than 5 measured relative to the base of the vibration table, the EUT shall be subjected to a vibration endurance test at each resonant frequency at the vibration level specified in the test with a duration of 2 hours. If no resonance with Q greater than 5 occurs the endurance test shall be carried out at one single observed frequency. If no resonance occurs the endurance test shall be carried out at a frequency of 30 Hz.

The test shall be repeated with vibration in each of the mutual perpendicular direction in the horizontal plane.

A performance check shall be carried out at least once during each endurance test period and once before the end of each endurance test period.

After conducting the vibration tests, the equipment shall be inspected for any mechanical deterioration.

It is recommended to perform the tests described in clauses 5.3.2.1 and 5.4.3 during this test.

5.3.1.5 Temperature tests

5.3.1.5.1 Dry heat

5.3.1.5.1.1 Internally mounted equipment

The equipment shall be placed in a chamber at normal room temperature. The temperature shall then be raised to, and maintained at, +55°C (±3°C) for a period of at least 10 hours.

After this period any climatic control device provided in the equipment may be switched on.

30 mins later, the equipment shall be switched on, and shall then be kept working continuously for a period of 2 hours.

The equipment shall be subjected to a performance check during the 2 hours period.

At the end of the test, and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than 1 hour. The equipment shall then be exposed to normal room temperature and humidity for not less than 3 hours before the next test is carried out.

5.3.1.5.1.2 Externally mounted equipment

The equipment shall be placed in a chamber at normal room temperature. The temperature shall be raised to and maintained at +70°C (±3°C) for a period of at least 10 hours.

After this period any climatic control device provided in the equipment may be switched on and the chamber cooled to +55°C (±3°C). The cooling of the chamber shall be completed within 30 mins.

The equipment shall then be switched on and shall be kept working continuously for a period of 2 hours.

The equipment shall be subjected to a performance check during the 2 hours period.

The temperature of the chamber shall be maintained at +55°C (±3°C) during the 2 hour period.

At the end of the test, and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than 1 hour. The equipment shall then be exposed to normal room temperature and humidity for not less than 3 hours before the next test is carried out.

5.3.1.5.2 Damp heat

The equipment shall be placed in a chamber at normal room temperature and humidity which, steadily, over a period of 3 hours (±0,5 hour), shall be heated from room temperature to +40°C (±3°C) and shall during this period be brought to a relative humidity of 93 % (±2 %) so that excessive condensation is avoided.

These conditions shall be maintained for a period of at least 10 hours.

After this period, any climatic control devices provided within the equipment may be switched on.

30 mins later the equipment shall be switched on, and shall then be kept working continuously for a period of 2 hours.

The equipment shall be subjected to a performance check during the 2 hour period.

The temperature and the relative humidity of the chamber shall be maintained at +40°C (±3°C) and 93 % (±2 %) during the 2 hours 30 mins period.

At the end of the test, and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than 1 hour. The equipment shall then be exposed to normal room temperature and humidity for not less than 3 hours, or until moisture has dispersed, which ever is longer, before the next test is carried out.

5.3.1.5.3 Low temperature cycle

5.3.1.5.3.1 Internally mounted equipment

The equipment shall be placed in a chamber at normal room temperature. The temperature shall then be reduced to, and maintained at, -15°C (±3°C) for a period of at least 10 hours.

After this period, any climatic control devices and/or heat sources provided in the equipment may be switched on.

The equipment shall then be subjected to a performance check lasting no more than 30 mins.

The temperature of the chamber shall be maintained at -15°C (±3°C) during the performance check.

At the end of the test, and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than 1 hour. The equipment shall then be exposed to normal room temperature for not less than 3 hours, or until moisture has dispersed, which ever is longer, before the next test is carried out.

5.3.1.5.3.2 Externally mounted equipment

The equipment shall be placed in a chamber at normal room temperature. The temperature shall then be reduced to, and maintained at, -30°C (±3°C) for a period of at least 10 hours.

Any climatic control devices provided in the equipment may then be switched on and the chamber warmed to -20°C (±3°C). The warming of the chamber shall be completed within 30 mins (±5 mins).

The temperature of the chamber shall then be maintained at -20°C (±3°C) during a period of 1 hour 30 mins.

The equipment shall be subjected to a performance check during the last 30 mins of the test. Any heat sources for the equipment may be switched on during the performance check.

At the end of the test, and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than 1 hour. The temperature shall then be exposed to normal room temperature for not less than 3 hours, or until moisture has dispersed, which ever is longer, before the next test is carried out.

Throughout the test the equipment shall be working normally.

5.3.1.6 Corrosion test

5.3.1.6.1 General

This test may be excluded if sufficient evidence is provided that the corresponding requirements of this clause are met.

5.3.1.6.2 Method of measurement

The equipment shall be placed in a chamber fitted with apparatus capable of spraying in the form of a fine mist a salt solution to the following formula:

- sodium chloride 26,50 g ± 10 %;
- magnesium chloride 2,50 g ± 10 %;
- magnesium sulphate 3,50 g ± 10 %;
- calcium chloride 1,10 g ± 10 %;
- potassium chloride 0,73 g ± 10 %;
- sodium bicarbonate 0,20 g ± 10 %;
- sodium bromide 0,28 g ± 10 %;
- plus distilled water to make the solution up to 1 l.

Alternatively a 5 % sodium chloride (NaCl) solution may be used.

The salt used for the test shall be high quality sodium chloride (NaCl) containing, when dry, not more than 0,1 % sodium iodide and not more than 0,3 % of total impurities.

Salt solution concentration shall be 5 % (±1 %) by weight.

The solution shall be prepared by dissolving, by weight, 5 parts ± 1 part of salt in 95 parts of distilled or de-mineralized water.

The pH value of the solution shall be between 6,5 and 7,2 at temperature of 20°C (±2°C). The pH value shall be maintained within this range during conditioning; for this purpose, diluted hydrochloric acid or sodium hydroxide may be used to adjust the pH value, provided that the concentration of NaCl remains within the prescribed limits. The pH value shall be measured when preparing each new batch of solution.

The spraying apparatus shall be such that the products of corrosion cannot mix with the salt solution contained within the spray reservoir.

The equipment shall be sprayed simultaneously on all its external surfaces with the salt solution for a period of 1 hour.

This spraying shall be carried out four times with a storage period of 7 days at 40°C (±2°C) after each spraying. The relative humidity during storage shall be maintained between 90 % and 95 %.

At the end of the total period the equipment shall be examined visually.

The equipment shall then be subjected to a performance check.

5.3.1.7 Rain test

5.3.1.7.1 General

The test shall only be performed for equipment intended to be mounted above deck.

5.3.1.7.2 Method of measurement

The equipment shall be placed in an appropriate measurement chamber.

Throughout the test the equipment shall be working normally.

The test shall be carried out by spraying the equipment from all practicable directions with a stream of water from a hose.

The conditions to be observed are as follows:

- internal diameter of the nozzle: 12,5 mm;
- delivery rate: 100 l/min (±5 %);
- water pressure at the nozzle: approximately 100 kPa (1 bar). The pressure shall be adjusted to achieve the specified delivery rate. At 100 kPa the water shall rise freely for a vertical distance of approximately 8 metres above the nozzle;
- test duration: 30 mins;
- distance from the nozzle to the equipment surface: approximately 3 m.

At the end of the test the equipment shall be subjected to a performance check and inspected.

Following inspection, the equipment shall be resealed in accordance with the manufacturer's instructions.

5.3.2 Conformance tests

5.3.2.1 Unwanted frequency modulation

The transmitter complete with chassis covers and shock absorbers (if supplied) shall be clamped in its normal operating position to a vibrating table and shall be connected to the appropriate artificial antenna as specified in clause 5.1.5.1.

The transmitter shall then be switched on, adjusted for the transmission of class of emission J3E and, after the warming-up period permitted under clause 5.1.7, shall be modulated by means of a test signal consisting of an audio frequency tone applied to the modulation input at a frequency of 1 000 Hz for SSB telephony or 1 700 Hz for DSC.

The level of the input test signal shall be adjusted to such a level that the output power is 3 dB below the result of the power measurement in EN 300 373-2 [7], clause 5.3.2.

Any frequency deviation shall be measured by means of a monitoring receiver using a suitable, calibrated, FM demodulator or frequency deviation meter. The deviation meter bandwidth shall be ±125 Hz. The table shall be vibrated as detailed in clause 5.3.1.4.

The test shall be performed on 2 182 kHz if the transmitter is designed to work in the 1 605 kHz to 4 000 kHz band only or on a frequency in the 8 MHz band if the equipment is designed to work on all maritime bands in the 1 605 kHz to 27 500 kHz range.

The results obtained shall be compared to the limits in clause 4.4.1.2 in order to prove compliance with the requirement.

5.3.2.2 Sensitivity of the microphone and the 600 Ω line inputs for SSB telephony

An acoustic tone at a frequency of 1 000 Hz and a sound level of 94 dBA shall be applied to the microphone and the output power measured.

An audio tone with a frequency of 1 000 Hz and a level of -16 dBm shall be applied to the 600 Ω line input terminals and the output power measured. The transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment.

The results obtained shall be compared to the limits in clause 4.4.2.2 in order to prove compliance with the requirement.

5.3.2.3 Automatic level control and/or limiter for SSB telephony

The transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment.

The transmitter shall be connected to the appropriate artificial antenna as specified in clause 5.1.5.1 and modulated to within 0 dB and -1 dB of the maximum output power as measured in EN 300 373-2 [7], clause 5.3.2, by a test signal consisting of four audio-frequency tones of equal amplitude, applied to the modulation input, at frequencies of 700 Hz, 1 100 Hz, 1 700 Hz and 2 500 Hz.

Where the level of the test signal is so low as to make its measurement impractical, it is permissible to employ a calibrated attenuator having a characteristic impedance equal to the transmitter input impedance as declared by the manufacturer. The input level to the transmitter may then be calculated from measurements of signal level at the input to the attenuator and the value of attenuation in circuit.

The level of the test signal shall be varied and the peak voltage of the input signal, together with the corresponding values of peak envelope power shall be measured at a sufficient number of points for a graph of input level against peak envelope power to be plotted. The graph shall be placed in figure 2 in such a way that it touches the upper limits at two points at least, without exceeding the upper limits anywhere.

The input signal level corresponding to -10 dB relative to rated output power shall be recorded.

The test shall be repeated using the 600 Ω audio line input.

The results obtained shall be compared to the limits in clause 4.4.3.2 in order to prove compliance with the requirement.

5.3.2.4 Audio frequency response of SSB telephony

The transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment.

The transmitter shall be connected to the appropriate artificial antenna described in clause 5.1.5.1 and modulated by a sinusoidal audio frequency test signal connected to the modulation input. The frequency of the test signal shall then be varied between 100 Hz and 10 kHz. The resulting radio frequency power shall be measured at the output of the transmitter using a selective method (e.g. spectrum analyser).

The level of the test signal shall be adjusted so that the output power at the peak of the response characteristic is 10 dB below the rated output power.

The test shall be repeated using the 600 Ω audio line input.

The results obtained shall be compared to the limits in clause 4.4.4.2 in order to prove compliance with the requirement.

5.3.2.5 Residual hum and noise power for telephony

The transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment.

The transmitter shall be connected to the appropriate artificial antenna described in clause 5.1.5.1. It shall then be modulated by a two-tone test signal to produce the maximum output power as measured in EN 300 373-2 [7], clause 5.3.2.

The test signal shall then be disconnected from the transmitter modulation input terminals and the radio frequency power shall be measured at the transmitter output within a frequency band which lies between the carrier frequency and 2 700 Hz above the carrier frequency.

The modulation input circuit terminals shall then be short-circuited and the radio frequency power shall be measured again. This test shall be repeated using the 600 Ω audio line input.

The results obtained shall be compared to the limits in clause 4.4.5.2 in order to prove compliance with the requirement.

5.3.2.6 Residual frequency modulation on DSC

The transmitter shall be connected to the appropriate artificial antenna described in clause 5.1.5.1. It shall then be modulated by a dot pattern to produce the maximum output power as measured in EN 300 373-2 [7], clause 5.3.2.

The RF output terminal of the equipment shall be fed to a suitable, calibrated, FM demodulator. The output of the demodulator shall be limited in bandwidth by a low-pass filter with a cut-off frequency of 1 kHz and a slope of 12 dB/octave. DC voltages shall be suppressed by an ac coupling device so that they do not influence the result of the measurement.

The RMS output level shall be measured during continuous transmission of the B or Y signal and during the transmission of continuous dot pattern.

The ratio of the two measured RMS output levels from the demodulator shall be determined.

The results obtained shall be compared to the limits in clause 4.4.6.2 in order to prove compliance with the requirement.

5.3.2.7 Continuous operation on telephony

The transmitter shall be connected to the artificial antenna as specified in clause 5.1.5.1 and driven to its maximum output power measured under EN 300 373-2 [7], clause 5.3.2 using the two-tone test signal as described in that clause. The equipment shall transmit continuously for a period of 15 mins.

The transmitter shall be tuned to the frequency 2 182 kHz for MF equipment or 8 291 kHz for MF/HF equipment.

The measurement shall be carried out under normal (see clause 5.1.3) and extreme test conditions (see clauses 5.1.4.1 and 5.1.4.2 applied simultaneously).

The results obtained shall be compared to the limits in clause 4.4.7.2 in order to prove compliance with the requirement.

5.3.2.8 Protection of transmitter

After the transmitter has been tuned and whilst the transmitter is being driven to the rated output power by the simultaneous application of two modulating signals of equal level, the antenna terminals shall first be short-circuited and then open-circuited, in each case for a period of 5 mins. This test shall be conducted on one frequency only. The frequency chosen shall be recorded in the test report.

The results obtained shall be compared to the limits in clause 4.4.8.2 in order to prove compliance with the requirement.

5.4 Other test specifications

5.4.1 General

The requirements in clauses 4.4.9 to 4.4.18 inclusive have been set on the assumption that the test specifications in clauses 5.4.2 to 5.4.11 will be used to verify the performance of the equipment.

5.4.2 Receiver frequency error

a) SSB telephony:

- a standard input signal for J3E at a level of +60 dBµV shall be applied to the receiver on the nominal frequency to which it is tuned. The frequency of the output at the 600 Ω terminals shall be measured and its difference from 1 000 Hz be recorded;

b) DSC with analogue input:

- a standard input signal for F1B shall be applied to the receiver on the assigned frequency to which it is tuned at level of +60 dBµV. The frequency of the output on the DSC 600 Ω terminals shall be measured and its difference from 1 700 Hz be recorded.

Measurement shall be made under normal test conditions (see clause 5.1.3) and under extreme test conditions (see clauses 5.1.4.1 and 5.1.4.2 applied simultaneously).

The results obtained shall be compared to the limits in clause 4.4.9.2 in order to prove compliance with the requirement.

5.4.3 Unwanted frequency modulation

The receiver, complete with chassis covers and shock absorbers (if supplied), shall be clamped in its normal operating position to a vibrating table.

The receiver shall then be switched on, adjusted for the reception of class of emission J3E and after the warming-up period permitted under clause 5.1.7 a radio frequency test signal as detailed in clause 5.1.6.2.1 shall be applied to its input at a level of +60 dBµV.

The receiver shall be adjusted to deliver standard output power at 1 kHz. The table shall be vibrated as detailed in clause 5.3.1.4. Any frequency deviation of the output signal occurring during this test, shall be measured using a suitable, calibrated, FM demodulator. The deviation meter bandwidth shall be ±125 Hz.

If the receiver does not have telephony facilities then the same test is performed using the reception of class of emission F1B with the appropriate test signal at the same levels but with an output frequency of 1 700 Hz.

The results obtained shall be compared to the limits in clause 4.4.10.2 in order to prove compliance with the requirement.

5.4.4 Pass band

5.4.4.1 Class of emission J3E

With the AGC operative, two unmodulated radio frequency test signals shall be applied to the input of the receiver in accordance with clause 5.1.6.1.

The frequency of one of these test signals shall be at a frequency 1 500 Hz above the carrier frequency to which the receiver is tuned, and its level shall be +60 dBµV. This stabilizes the gain of the receiver. The other test signal shall be at a level +50 dBµV and shall be varied in frequency from the nominal carrier frequency to 10 kHz above the carrier frequency, and its resultant audio output voltage and frequency shall be measured at a sufficient number of points, using a spectrum analyser or selective voltmeter, to enable the audio frequency pass band to be determined.

When measuring in the vicinity of 1 500 Hz, the frequency of the gain-stabilizing input signal shall be displaced to a frequency just outside the pass-band of the measuring instrument.

The results obtained shall be compared to the limits in clause 4.4.11.2 in order to prove compliance with the requirement.

5.4.5 Reciprocal mixing

The measurement shall be carried out with the receiver in the mode of operation J3E, with the AGC operative, the RF/IF gain control (if fitted) at its maximum and any input attenuator at its minimum attenuation. The measurements shall be made by the simultaneous application of two test signals to the input of the receiver. One of the test signals is the wanted signal to which the receiver is tuned and the other the unwanted signal.

The wanted test signal shall be the normal test signal specified in clause 5.1.6.2 with a level of +60 dBµV. The receiver shall be adjusted so that the wanted signal gives standard output power.

The unwanted signal shall have a frequency separation of ±20 kHz, or more, relative to that of the receiver frequency and shall be unmodulated.

The input level of the unwanted signal is adjusted until it causes a reduction in the SNR to 30 dB. The input level of the unwanted signal is recorded and shall be taken as the reciprocal mixing level.

Care should be taken in the measurement to avoid the effects of distortion.

Care should be taken to ensure that the noise sideband of the generators representing the wanted, and especially the unwanted signals, does not influence the measurements.

The results obtained shall be compared to the limits in clause 4.4.12.2 in order to prove compliance with the requirement.

5.4.6 Harmonic content in output

This test shall be performed with rated output power and with standard output power. The test signals as defined in clause 5.1.6.2 shall be applied to the receiver input applicable for all modes of analogue modulation.

The level of the input signal shall be varied between +30 dBµV and +80 dBµV, while maintaining the output level at the standard output power and then at the rated output power. The harmonic content shall then be measured.

The results obtained shall be compared to the limits in clause 4.4.13.2 in order to prove compliance with the requirement.

5.4.7 Audio frequency intermodulation

With the AGC operative, the manual RF/IF gain control (if provided) at its maximum, and any input attenuator adjusted to its minimum attenuation, an unmodulated signal, 1 100 Hz above the frequency to which the receiver is tuned, at a level of +60 dBµV shall be applied to the input of the receiver. In addition a second unmodulated signal, 1 700 Hz above the frequency to which the receiver is tuned shall be applied and its level shall be adjusted until the 1 100 Hz and the 1 700 Hz signals in the output of the receiver are of equal amplitude.

By means of the audio frequency gain control the total output power of the receiver shall be adjusted to standard output power.

The audio frequency intermodulation components shall then be measured.

The results obtained shall be compared to the limits in clause 4.4.14.2 in order to prove compliance with the requirement.

5.4.8 Internally generated spurious signals

The receiver shall have no input signal and be terminated at its antenna input with a load impedance equal to those specified in clause 5.1.5. The receiver shall be set to J3E mode and a search made throughout the bands for whistles in the output. For conformance testing manufacturers may need to provide a means for quickly searching the bands in steps of no more than 1 kHz.

The results obtained shall be compared to the limits in clause 4.4.15.2 in order to prove compliance with the requirement.

5.4.9 AGC efficiency

5.4.9.1 Settings

To check the performance of the AGC, tests shall be carried out with the receiver adjusted for each maritime mobile band. The input signal shall be the appropriate normal test signal specified in clause 5.1.6.2. The characteristics shall be checked at all audio outputs.

5.4.9.2 Increase in Signal-to-Noise Ratio (SNR)

For each test the input signal shall have a level equal to the maximum usable sensitivity measured according to EN 300 373-2 [7], clause 5.4.2. The input level shall then be increased by 20 dB. The SNR shall then increase by at least 15 dB.

Care should be taken in the measurement to avoid the effects of distortion.

The results obtained shall be compared to the limits in clause 4.4.16.2 in order to prove compliance with the requirement.

5.4.10 AGC time constants (attack and recovery time)

A test signal (see clause 5.1.6.2) shall be applied to the input of the receiver set in the J3E mode via an attenuator capable of being switched in a single step of 30 dB without interrupting the test signal. The resulting audio output shall be displayed by means of an oscilloscope.

The input level shall be adjusted to produce an output SNR ratio of 20 dB, and the output level adjusted to 10 dB below the standard audio-frequency output power. The attenuator shall then be switched so that the input signal increases in level by 30 dB.

The attack time shall then be measured. The attenuator shall then be switched so that the input signal returns to its original level. The recovery time shall be measured.

Care should be taken in the measurement to avoid the effects of distortion.

The results obtained shall be compared to the limits in clause 4.4.17.2 in order to prove compliance with the requirement.

5.4.11 Protection of input circuits

An unmodulated radio frequency test signal, at a level of 30 V RMS is applied, in the manner specified in clause 5.1.6 to the receiver input for a period of 15 mins.

The test shall be performed on 2 182 kHz if the equipment is designed to operate in the 1 605 kHz to 4 000 kHz bands only, or on a frequency in the 8 MHz band if the equipment is designed to operate on all maritime bands in the 1 605 kHz to 27 500 kHz range.

The results obtained shall be compared to the limits in clause 4.4.18.2 in order to prove compliance with the requirement.

Annex A (normative): The EN Requirements Table (EN-RT)

The EN Requirements Table (EN-RT) serves a number of purposes, as follows:

- it provides a tabular summary of all the requirements;
- it shows the status of each EN-R, whether it is essential to implement in all circumstances (Mandatory), or whether the requirement is dependent on the supplier having chosen to support a particular optional service or functionality (Optional). In particular it enables the EN-Rs associated with a particular optional service or functionality to be grouped and identified;
- when completed in respect of a particular equipment it provides a means to undertake the static assessment of conformity with the EN.

Table A.1: EN Requirements Table (EN-RT)

EN Reference		EN 300 373-3				Comment
No.	**Reference**	**EN-R (note)**	**Status**			
1	4.2	General, operational and technical requirements	M			
2	4.3.1	Vibration	M			
3	4.3.2.2.2	Dry heat	M			
4	4.3.2.3.2	Damp heat	M			
5	4.3.2.4.2	Low temperature	M			
6	4.3.3.2	Corrosion	M			
7	4.3.4.2	Rain	M			
8	4.4.1	Unwanted frequency modulation	M			
9	4.4.2	Sensitivity of the microphone and the 600 Ω line inputs for SSB telephony	M			
10	4.4.3	Automatic level control and/or limiter for SSB telephony	M			
11	4.4.4	Audio frequency response of SSB telephony	M			
12	4.4.5	Residual hum and noise power for telephony	M			
13	4.4.6	Residual frequency modulation on DSC	M			
14	4.4.7	Continuous operation of telephony	M			
15	4.4.8	Protection of transmitter	M			
16	4.4.9	Receiver frequency error	M			
17	4.4.10	Unwanted frequency modulation	M			
18	4.4.11	Pass band	M			
19	4.4.12	Reciprocal mixing	M			

EN Reference		EN 300 373-3				Comment
No.	Reference	EN-R (note)	Status			
20	4.4.13	Harmonic content in output	M			
21	4.4.14	Audio frequency intermodulation	M			
22	4.4.15	Internally generated spurious signals	M			
23	4.4.16	AGC efficiency	M			
24	4.4.17	AGC time constants	M			
25	4.4.18	Protection of input circuits	M			
NOTE: These EN-Rs are justified under article 3.3 e) of the R&TTE Directive.						

Key to columns:

No Table entry number;

Reference Clause reference number of conformance requirement within the present document;

EN-R Title of conformance requirement within the present document;

Status Status of the entry as follows:

M Mandatory, shall be implemented under all circumstances;
O Optional, may be provided, but if provided shall be implemented in accordance with the requirements;
O.n this status is used for mutually exclusive or selectable options among a set. The integer "n" shall refer to a unique group of options within the EN-RT. A footnote to the EN-RT shall explicitly state what the requirement is for each numbered group. For example, "It is mandatory to support at least one of these options", or, "It is mandatory to support exactly one of these options".

Comments To be completed as required.

Annex B (normative): Class E Digital Selective Calling

B.1 General, operational and technical requirements

Where the equipment has additionally implemented Class E Digital Selective Calling, it shall be in compliance with the following requirements.

B.1.1 General and operational requirements

B.1.1.1 Composition

In addition to the requirements of clause 4.2 the equipment shall contain the following:

- a dedicated watchkeeping receiver for the DSC decoder;
- a DSC encoder; and
- a DSC decoder.

B.1.1.2 Frequencies

The dedicated watchkeeping receiver shall be capable of operation on one or more of the following frequencies:

- MF equipment: 2 187,5 kHz;
- HF equipment: 4 207,5 kHz, 6 312 kHz, 8 414,5 kHz, 12 577 kHz and 16 804,5 kHz.

B.1.1.3 Controls and indicators

In addition to the requirements of clause 4.2.2.3 the following controls or functions shall be provided:

- DISTRESS BUTTON (clause B.1.1.4.3): The default shall be an undesignated distress message;
- CALL: The default (initial display) shall be an individual call;
- CANCEL: to revert to the initial display. The cancel function shall take place automatically after a maximum of 5 mins of inactivity;
- ENTER/Accept/OK: for accepting a menu item;
- NUMERIC KEY PAD: for instance for entering MMSI for calling and manual position information. This shall conform to ITU-T Recommendation E.161 [9];
- ALPHA - NUMERIC DISPLAY;

B.1.1.4 Facilities for coding and decoding of DSC

B.1.1.4.1 Call functions

The facilities for coding and composition of calls shall be so arranged that it is possible for the operator quickly and precisely to enter a call.

The CALL functions shall permit selection of the following functions:

- INDIVIDUAL: for making a call to a specific MMSI;

- ALL SHIPS URGENCY/SAFETY: for making all ships calls;
- RECEIVED CALLS: for retrieving stored incoming DSC calls;
- OTHER: for equipment housekeeping functions.

If INDIVIDUAL is selected, either a MANUAL call or a DIRECTORY call shall be selected. The DIRECTORY list shall have a facility for at least 10 entries. Their MMSIs shall be programmable.

B.1.1.4.2 MANUAL calls

The MANUAL call facility shall permit the entry of a MMSI. If the called station is a coast station (i.e. MMSI commencing 00) no further information shall be requested from the operator. If the called station is a ship station the equipment shall request input of a channel number. The equipment shall assist the operator by suggesting a suitable inter-ship channel.

B.1.1.4.3 Distress calls

It shall only be possible to transmit distress DSC calls by means of a single dedicated button which is used for no other purpose. This button shall not be any key of ITU-T Recommendation E.161 [9] digital input panel or an ISO keyboard provided on the equipment. This button shall be clearly identified and protected against inadvertent operation with a non removable, spring loaded cover.

The distress alert initiation shall require at least two independent actions. A visual indication and an acoustic alarm shall be provided to show that a distress alert has been initiated. There shall be a time delay of at least 3 s between initial operation of the button and the alert being activated.

It shall be possible to select the nature of distress prior to initiating the transmission of a distress call. The default nature of distress shall be the undesignated distress.

Initiation of a distress call shall automatically have priority over any other operation of the equipment. The equipment shall automatically select the maximum transmitter power.

Manual means shall be provided to discontinue transmission of a distress call.

The distress call shall be a single frequency call with a default of 2 187,5 kHz and the call shall be automatically transmitted five times in succession with no intervals between the individual calls so that bit synchronization between the transmitter and receiver of the call can be maintained. Each call shall include the appropriate dot pattern.

After the transmission of the distress call sequence the equipment shall automatically tune to the appropriate distress frequency for telephony in the band where the distress call was made and select the maximum transmitter power.

B.1.1.4.4 ALL SHIPS calls

It shall only be possible to transmit ALL SHIPS URGENCY and ALL SHIPS SAFETY calls by means of deliberate actions, such as two levels of menu instructions.

B.1.1.4.5 Incoming calls

The DSC equipment shall be provided with suitable facilities for converting incoming calls with relevant address content to visual form in plain language. The contents of at least the last 10 received DSC calls shall be stored until read manually from the RECEIVED CALL menu.

The radiotelephone shall be capable of automatically switching to any channel identified in an incoming call. In the case of incoming distress and urgency calls the radiotelephone shall switch to the appropriate distress frequency for telephony in the band where the call was received and shall automatically select the maximum transmitter power.

B.1.1.5 DSC display

The equipment shall be provided with a 160 character display facility which shows the functions currently available, prompts the operator if an incorrect operation is attempted, displays error messages and displays incoming and logged calls. When the equipment is not in use for normal communications purposes, it should display the last entered position.

The equipment shall be provided with facilities for visual indication, and possible manual correction of the user programmable information content of the call before the call is sent.

There shall be an indication that unread incoming messages are present in memory. Indications shall be provided that a distress alert is in automatic retransmit mode.

B.1.1.6 External loudspeaker

Where there are connections to external loudspeakers, these shall also relay acoustic alarms.

B.1.1.7 Memory data

The information in programmable memory devices and the vessel's identity and information inherent to the DSC process shall be stored in non-volatile memory devices.

B.1.1.8 Labelling

Void.

B.1.1.9 Warm up

After being switched on, the equipment shall be operational within 5 s.

B.2 Technical requirements

B.2.1 Class of emission

For the purposes of digital selective calling the equipment shall offer one of the following:

F1B	frequency modulation, single channel containing quantized or digital information without the use of a modulating sub-carrier, telegraphy for automatic reception.
J2B	SSB, suppressed carrier, single channel containing quantized or digital information with the use of a modulating sub-carrier, telegraphy for automatic reception.

B.2.2 Facilities for DSC transmission and reception

B.2.2.1 General

The equipment shall comprise the necessary facilities for coding and transmission of DSC on the frequencies stated in clause B.1.1.2 and for decoding and conversion of the information content of received DSC to visual form in plain language.

The equipment may be either:

a) an independent unit for connection to an associated radiotelephone; or

b) mechanically and electrically integrated in such radio equipment.

However in both cases the DSC equipment shall be capable of automatic channel switching in the radio equipment.

The watchkeeping receiver part of the DSC equipment shall be designed for continuous operation on the frequencies stated in clause B.1.1.2 but the receiver need not operate when the transmitter is in use.

B.2.2.2 Decoding

The DSC equipment shall be so designed that in the decoding process use shall be made of parity bits for error detection, time diversity repetitions and error check characters in the received call as specified in ITU-R Recommendation M.493-10 [5].

B.2.2.3 Free channel transmission

The DSC equipment shall be provided with facilities which, except for distress calls, automatically delay the transmission of DSC until the selected calling frequency is free.

B.2.2.4 Automatic acknowledgement

The equipment shall not be provided with facilities for automatic transmission of acknowledgements.

B.2.2.5 Automatic re-transmission of distress calls

Where no DSC distress acknowledgement is received, the equipment shall automatically re-transmit the distress call attempt on the selected frequency after a random delay of between 3 ½ and 4 ½ mins from the beginning of the previous call.

After the transmission of each distress call attempt the equipment shall automatically re-tune to the appropriate distress frequency for telephony in the band where the distress call was made and select the maximum transmitter power.

This sequence shall be continued until a DSC distress acknowledgement has been received, or until the automatic transmission of the distress call is discontinued manually.

Means shall be provided for transmitting the distress call attempt again by manual intervention at any time.

B.2.3 Ships identity - MMSI and Group MMSI

The equipment shall be capable of storing permanently the ship's 9-digit Maritime Mobile Service Identity (MMSI) number which shall be inserted automatically in the call. The 10th digit shall be added automatically set to zero. It shall not be possible to change the identity number using any combination of operator controls. It shall not be possible to transmit a DSC call until the ship's MMSI has been stored.

Facilities shall be provided to permit the operator to program and store a Group MMSI number to enable the equipment to recognize calls addressed to both the ship's MMSI and the Group MMSI. These facilities shall limit the number of operator programmable digits to 8 and the leading zero shall be automatically inserted by the equipment.

B.2.4 Entry of position information

Means shall be provided for manual entry of the geographical position information and of the time when this position information was valid. In addition, facilities for automatic entry and encoding of the geographical position and time information shall be provided. Such facilities shall conform with IEC 61162-1 [8].

No connection of, or failure within, any external circuits shall disable the DSC equipment. In the event of failure of the data stream (IEC 61162-1 [8]) an error message shall be shown and the operator prompted for a manual input of position every four hours.

If the position information has not been updated for 23,5 hours the position shall default to the repeated digit "9" as specified in ITU-R Recommendation M.493-10 [5].

B.2.5 Alarm circuits

B.2.5.1 Distress and urgency

The equipment shall be provided with a specific acoustic alarm and a visual indication, activated automatically when a call with format specifier distress or category distress or urgency has been received. It shall not be possible to disable these alarm circuits.

B.2.5.2 Other categories

The equipment shall be provided with an acoustic alarm and a visual indication, activated automatically on receipt of calls of categories other than distress and urgency. It shall not be possible to disable the acoustic alarm circuit.

B.2.5.3 Acoustic alarms

The acoustic power of an alarm shall be at least 80 dB(A) at a distance of 1 m from the equipment. For equipment that implements progressive level alarms, this level shall be achieved within 30 seconds.

B.2.5.4 Cancellation of alarms

A means of manual cancellation of alarms shall be provided. In the event that an alarm is not cancelled manually, then automatic cancellation shall take place after 2 mins.

B.2.6 Watch facilities

B.2.6.1 General

Equipment having a scanning watch receiver shall comply with the following:

The watch receiver/decoder shall correctly receive calls preceded by more than 20 bits of a 200 bit dot pattern and transmitted on one frequency whilst scanning up to six frequencies, ignoring all other signals and noise.

B.3 Technical requirements and methods of test for the watch receiver and associated DSC decoder

B.3.1 Scanning watch receiver efficiency

B.3.1.1 Definition

Scanning efficiency is the ability of the receiver/decoder to correctly receive calls preceded by more than 20 bits of a 200 bit dot pattern and transmitted on one frequency whilst scanning up to six frequencies ignoring all other signals and noise.

B.3.1.2 Method of measurement

Two RF test signals with a level of 20 dBµV shall be applied to the receiver.

One of the RF signals shall have a nominal frequency corresponding to a frequency in the scanning sequence and shall be modulated with a single DSC distress call.

The other RF signal shall have a nominal frequency corresponding to another frequency being scanned. It shall be continuously modulated by DSC calls with 20 bit dot pattern.

The distress call sequences shall be repeated after a random interval of 2,5 s to 4,0 s.

The receiver shall be set to scan the maximum number of frequencies for which it is designed.

The number of transmitted distress calls shall be 200 and the symbol error rate shall be determined.

B.3.1.3 Limits

The total number of received distress calls shall be equal to or exceed 95 % of distress calls transmitted and the symbol error rate shall be $\leq 10^{-2}$.

B.3.2 Calling sensitivity

B.3.2.1 Definition

The calling sensitivity of the receiver is a defined RF signal level at which the receiver gives a symbol error rate better than or equal to 10^{-2}.

B.3.2.2 Method of measurement

The receiver input terminal shall be connected to the artificial antenna specified in clause 5.1.5.2 and a test signal containing DSC calls shall be applied. The level of the test signal shall be 0 dBµV at the beginning of the test.

The symbol error rate in the decoder output shall be determined.

The input level shall be reduced until the symbol error rate is equal to or less than 10^{-2}, this level shall be recorded.

The measurement shall be repeated at the nominal input frequency ±10 Hz.

The measurements shall be carried out under normal test conditions (clause 5.1.3) and under extreme test conditions (clause 5.1.4).

B.3.2.3 Limits

The sensitivity shall be less than 0 dBµV under normal and better than 6 dBµV under extreme conditions.

B.3.3 Adjacent channel selectivity

B.3.3.1 Definition

Adjacent channel selectivity is defined as the suppression of an unwanted signal, expressed as the symbol error rate caused by the unwanted signal in the output from the decoder.

B.3.3.2 Method of measurement

The arrangements for applying the test signals shall be in accordance with clause 5.1.6.1.1.

The wanted RF signal shall be a signal containing DSC calls, and the level of the wanted signal shall be 20 dBµV.

The unwanted signal shall be an unmodulated signal at the frequency +500 Hz and then -500 Hz relative to the nominal frequency of the receiver (centre frequency).

The symbol error rate in the decoder output shall be determined.

The level of the unwanted signal shall then be increased until the symbol error rate is equal to 10^{-2}, this level shall be recorded.

The measurement shall be carried out under normal test conditions (clause 5.1.3) and under extreme test conditions (clause 5.1.4).

B.3.3.3 Limits

The level of the unwanted signal shall not be less than 60 dBµV under normal test conditions and not less than 54 dBµV under extreme test conditions.

B.3.4 Co-channel rejection

B.3.4.1 Definition

The co-channel rejection is the ability of the receiver to receive a wanted signal in the presence of an unwanted signal, both signals being on the wanted channel of the receiver.

B.3.4.2 Method of measurements

The arrangements for applying the test signals shall be in accordance with clause 5.1.6.1.1.

The wanted signal shall be a signal containing DSC calls, and the level of the wanted signal shall be 20 dBµV.

The unwanted signal shall be unmodulated.

The symbol error rate in the decoder output shall be determined.

The input level of the unwanted signal shall be increased until the symbol error rate is equal to 10^{-2}, this level shall be recorded.

B.3.4.3 Limits

The level of the unwanted signal shall not be less than 14 dBµV.

B.3.5 RF intermodulation response

B.3.5.1 Definition

The RF intermodulation response is defined as the rejection of intermodulation products originating from two unwanted signals with given levels and frequencies, expressed as that level at which the symbol error rate is 10^{-2}.

B.3.5.2 Method of measurement

The signals applied to the receiver input shall be connected in accordance with clause 5.1.6.1.1.

The wanted signal shall be a signal containing DSC calls, and the level of the wanted signal shall be 20 dBµV.

The two unwanted signals are both unmodulated and at the same level. Neither of the two signals shall be at a frequency nearer to the wanted signal than 30 kHz (frequency combinations capable of resulting in unwanted intermodulation products are given in ITU-R Recommendation SM.332-4, section 6.4 (see bibliography).

The symbol error rate in the decoder output shall be determined.

The levels of the two unwanted signals shall then be increased together until the symbol error rate is 10^{-2}, this level shall be recorded.

B.3.5.3 Limits

The levels of the unwanted signals shall not be less than 70 dBµV.

B.3.6 Interference rejection and blocking immunity

B.3.6.1 Definition

The interference rejection and blocking immunity is the ability of the receiver to discriminate between a wanted signal and unwanted signals with frequencies outside the passband of the receiver.

B.3.6.2 Method of measurement

The wanted signal and an unmodulated unwanted signal shall be applied to the receiver input in accordance with clause 5.1.6.1.1.

The wanted signal shall be a signal containing DSC calls, and the level of the wanted signal shall be 20 dBµV.

The symbol error rate in the decoder output shall be determined.

The input level of the unwanted signal shall be increased until the symbol error rate is 10^{-2}, this level shall be recorded.

B.3.6.3 Limits

The level of the unwanted signal shall not be less than 60 dBµV for frequencies from +1 kHz to +3 kHz and from -1 kHz to -3 kHz relative to the nominal frequency. The level of the unwanted signal shall not be less than 90 dBµV for frequencies from 9 kHz to 2 GHz with the exception of the frequency band ±3 kHz from the nominal frequency.

B.3.7 Dynamic range

B.3.7.1 Definition

The dynamic range of the equipment is the range from the minimum to the maximum level, of a radio frequency input signal at which the symbol error rate in the output of the decoder does not exceed a specified value.

B.3.7.2 Method of measurement

A signal containing DSC calls, shall be applied to the receiver input. The rf level of this signal shall alternate between 80 dBµV and 0 dBµV.

The symbol error rate in the decoder output shall be determined.

B.3.7.3 Limits

The symbol error rate in the decoded call sequences shall be 1×10^{-2} or less.

B.3.8 Conducted spurious emissions

B.3.8.1 Definition

Conducted spurious emissions are all internally generated signals conducted to the antenna terminal, irrespective of the frequency.

B.3.8.2 Method of measurement

The receiver input shall be connected to the artificial antenna specified in clause 5.1.6.1.1, and the spurious emissions shall be measured, using a selective measuring instrument. The rms value of any component of the spurious emission is then evaluated.

The measurement shall be made over the frequency range from 9 kHz to 2 GHz.

The bandwidth of the selective analyser shall be:

- 200 Hz in the frequency range from 9 kHz to 150 kHz;
- 9 kHz to 10 kHz in the frequency band from 150 kHz to 30 MHz;
- 100 kHz to 120 kHz in the frequency band 30 MHz to 1 GHz;
- 1 MHz above 1 GHz.

The detector shall be a peak detector.

B.3.8.3 Limits

The power of any discrete frequency component shall not exceed 2 nW.

B.4 Testing of generated call sequences

B.4.1 Definition

Generated call sequences are calls which comply with the requirements of ITU-R Recommendation M.493-10 [5].

B.4.2 Limit

The requirements of ITU-R Recommendation M.493-10 [5] regarding message composition and content shall be met.

The generated calls shall be analysed with the calibrated apparatus for correct configuration of the signal format, including time diversity.

It shall be verified that, after transmission of a DSC call, the transmitter re-tunes to the original channel. However in the case of a distress call the transmitter shall tune to the appropriate distress frequency for telephony in the band where the distress call was made and automatically select the maximum power.

B.4.3 Conformance

The equipment shall correctly generate DSC calls using the following:

- Format specifiers: Distress (112), All Ships (116), Individual (120).
- Category: Distress (112), Urgency (110), Safety (108), Routine (100).
- MMSI: Self ID and called party ID.
- Messages: Nature of distress with the exception of EPIRB (112), distress co-ordinates, time for last position update, J3E shall be used for all subsequent communications.
- 1st Telecommand: J3E telephony (109), Unable to comply (104), Test (118).
- 2nd Telecommand: No information (126).

B.5 Verification of correct decoding of various types of DSC calls

B.5.1 Definition

DSC call sequences are calls that comply with ITU-R Recommendation M.493-10 [5].

B.5.2 Limit

The requirements of ITU-R Recommendation M.493-10 [5] regarding message composition and content shall be met.

The decoded call sequences at the output of the receiver shall be examined for correct technical format, including error-check characters.

When receiver measurements are made by use of a printer or a computer, a check shall be made to ensure accordance between printer output and display indication.

It shall be verified that the equipment is capable of switching to a channel identified in the DSC call.

The telecommands used and channels tested for switching shall be stated in the test report.

B.5.3 Conformance

The equipment shall correctly decode DSC calls using the following:

- Format specifiers: Distress (112), All Ships (116), Individual (120).
- Category: Distress (112), Urgency (110), Safety (108), Routine (100).
- MMSI: Self ID and called party ID.
- Messages: Nature of distress (112), distress co-ordinates, time for last position update, J3E shall be used for all subsequent communications.
- 1st Telecommand: J3E telephony (109), Unable to comply (104), Test (118), Distress acknowledgement (110), Distress relay (112) when the format specifier is Geographical area call (102).
- 2nd Telecommand: No information (126).

In addition to the requirements already listed in table A.1, the following supplementary requirements are added.

Table B.1: EN Requirements Table (EN-RT) related to Class E DSC equipment

EN Reference		EN 300 373-3 Annex B				Comment
No.	**Reference**	**EN-R (note)**	**Status**	**Class(es) applicable**		
1	B.1	General, operational and technical requirements	M	All		
2	B.2	Technical requirements	M	All		
3	B.3.1	Scanning watch receiver efficiency	M	All		
4	B.3.2	Calling sensitivity	M	All		
5	B.3.3	Adjacent channel selectivity	M	All		
6	B.3.4	Co-channel rejection	M	All		
7	B.3.5	RF intermodulation response	M	All		
8	B.3.6	Interference rejection and blocking immunity	M	All		
9	B.3.7	Dynamic range	M	All		
10	B.3.8	Conducted spurious emissions	M	All		
11	B.4	Testing of generated call sequences	M	All		
12	B.5	Verification of correct decoding of various types of DSC calls	M	All		
NOTE: These EN-Rs are justified under article 3.3 e) of the R&TTE Directive.						

Annex C (informative): Bibliography

- Commission Decision 2000/638/EC of 22 September 2000 on the application of Article 3(3)(e) of Directive 1999/5/EC to marine radio communication equipment intended to be fitted to seagoing non-SOLAS vessels and which is intended to participate in the global maritime distress and safety system (GMDSS) and not covered by Council Directive 96/98/EC on marine equipment.

- ETSI EN 301 843 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for marine radio equipment and services".

- CEN EN 60945 (2002): "Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results".

- ETSI EN 300 373-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Maritime mobile transmitters and receivers for use in the MF and HF bands; Part 1: Technical characteristics and methods of measurement".

- ITU-R Recommendation SM.332-4: "Selectivity of receivers".

Annex D (informative): The EN title in the official languages

Language	EN title
Danish	Elektromagnetisk kompatibilitet og Radiospektrum Anliggender (ERM); Maritime mobile sendere og modtagere til brug i MF og HF båndene; Del 3: Harmoniseret EN, som dækker de væsentlige krav i R&TTE direktivets artikel 3.3e
Dutch	Elektromagnetische Compatibiliteit en Radio spectrum zaken(ERM); Maritieme mobiele zenders en ontvangers voor gebruik in de MF en HF banden; Deel 3: Geharmoniseerde EN welke invulling geeft aan essentiële vereisten neergelegd artikel 3.3(e) van de R&TTE richtlijn
English	Electromagnetic compatibility and Radio spectrum Matters (ERM); Maritime mobile transmitters and receivers for use in the MF and HF bands; Part 3: Harmonized EN covering essential requirements under article 3.3(e) of the R&TTE Directive
Finnish	Sähkömagneettinen yhteensopivuus ja radiospektriasiat (ERM); Siirtyvän meriradioliikenteen MF ja HF -taajuusalueiden lähettimet ja vastaanottimet; Osa 3: R&TTE-direktiivin artiklan 3.3(e) mukaiset olennaiset vaatimukset määrittelevä harmonisoitu standardi (EN)
French	Compatibilité électromagnétique et Spectre radioélectrique (ERM); Emetteurs et récepteurs mobiles maritimes fonctionnant dans les bandes d'ondes hectométriques et décamétriques; Partie 3: EN harmonisée couvrant les exigences essentielles de l'article 3.3(e) de la Directive R&TTE
German	Elektromagnetische Vertraglichkeit und Funkspektrumsangelegenheiten (ERM); Seefunkeinrichtungen, mobile Sender und Emfanger fur den Mittel- und Kurzwellenbereich; Teil 3: Harmonisierte Europaische Norm (EN) mit wesentlichen Anforderungen nach R&TTE Richtlinie Artikel 3.3(e)
Greek	Ηλεκτρο μαγνητική συ μβατότητα και θέ ματα ραδιοφά σματος (ERM); Φορητοί πομποί για ναυτηλία και δέκτες για χρήση στις ζώνες MF και HF; Μέρος 3ο: Εναρμονισμένη EN που καλύπτει τις βασικές προυποθέσεις σύμφωνα με το άρθρο 3.3(e) της οδηγίας R&TTE
Italian	Compatibilità elettromagnetica e Questioni relative allo spettro delle radiofrequenze (ERM); Trasmettitori e ricevitori marittimi mobili per uso nelle gamme di frequenza MF e HF; Parte 3: EN armonizzata relativa ai requisiti essenziali dell'articolo 3, paragrafo 3, comma e, della direttiva R&TTE
Portuguese	Assuntos de Espectro Radioeléctrico e Compatibilidade Electromagnética (ERM); Transmissores e Receptores para o Serviço Móvel Marítimo operando nas faixas de MF e HF; Parte 3: EN Harmonizada cobrindo os requisitos essenciais no âmbito do artigo 3º, nº 3, alínea e) da directiva R&TTE
Spanish	Compatibilidad electromagnética y cuestiones de espectro de radiofrecuencia (ERM); Radioteléfonos transmisores y receptores para el servicio móvil marítimo operando en las bandas de MF y HF; Parte 3: EN armonizada cubriendo los requisitos esenciales según el artículo 3.3(e) de la Directiva 1999/5/CE (R&TTE)
Swedish	Elektromagnetisk kompatibilitet och radiospektrumfrågor (ERM); Maritima mobila sändare och mottagare för användning i MF-och HF-banden; Del 3: Harmoniserad EN omfattande väsentliga krav enligt artikel 3.3 (e) i R&TTE-direktivet

History

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