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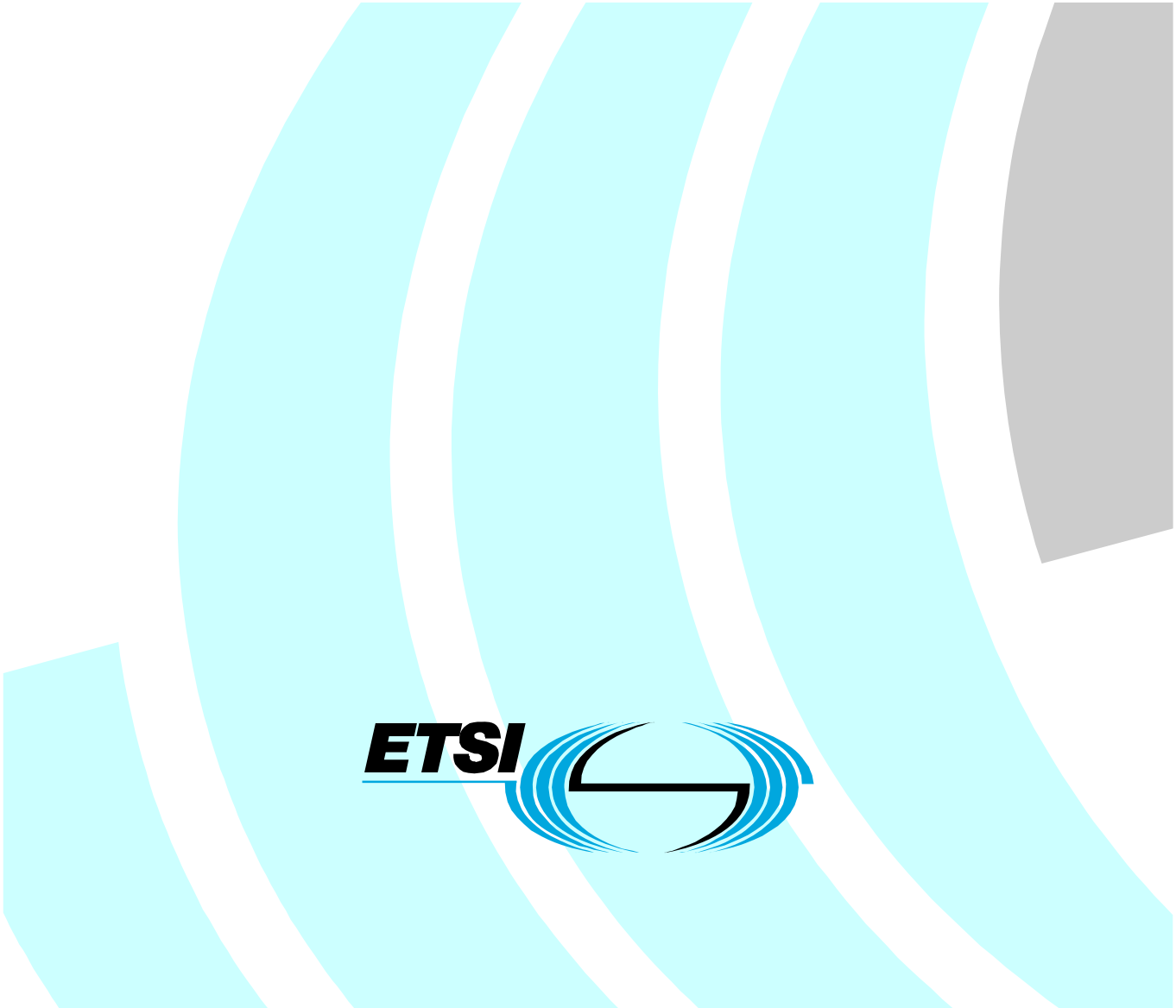
Harmonized European Standard (Telecommunications series)

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; Equipment with integrated or associated equipment for Class E Digital Selective Calling (DSC)



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Contents

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Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Vote phase of the ETSI standards Two-step Approval Procedure.

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) [i.2] laying down a procedure for the provision of information in the field of technical standards and regulations and following the Commission Decision 2004/71/EC [i.5] of 4 September 2003.

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 [i.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").

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

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; Equipment with integrated or associated equipment for Class E Digital Selective Calling (DSC)".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

1 Scope

The present document applies to radio transmitters and receivers, for use on vessels operating in either the Medium Frequency (MF) 1 606,5 kHz to 4 000 kHz bands only, or in the Medium and High Frequency (MF/HF) 1 606,5 kHz to 27,5 MHz bands allocated in the International Telecommunications Union (ITU) Radio Regulations [1], 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.

The present document refers to radio equipment, which is either fitted with an integrated DSC controller or fitted with a dedicated interface for a DSC controller.

The present document is intended to cover the provisions of Directive 1999/5/EC [i.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".

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 [i.1] will apply to equipment within the scope of the present document.

2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ITU Radio Regulations (2008).

[2] ETSI EN 300 373-2 (V1.1.2): "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".

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

[4] ETSI EN 300 338-4 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 4: Class E DSC".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.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).

[i.2] 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.

[i.3] 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".

[i.4] ETSI TR 100 028: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.5] Commission Decision 2004/71/EC of 4 September 2003 on essential requirements relating to marine radio communication equipment which is intended to be used on non-SOLAS vessels and to participate in the Global Maritime Distress and Safety System (GMDSS).

[i.6] CENELEC EN 60945 (2002): "Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results".

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 [i.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 complies with the provisions of the present document

rated output power: (of the receiver) rated output power of the receiver is the output power of the receiver as declared by the manufacturer that complies with both the minimum audio power and maximum total harmonic distortion at the same time

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

3.2 Symbols

For the purposes of the present document, the symbols given in the ITU Radio Regulations [1] and the following apply:

dB	decibel
dBm	dBmilliwatt
dBµV	dBmicrovolt
F1B	frequency modulation, single channel containing quantized or digital information without the use of a modulating sub-carrier, telegraphy for automatic reception
g	gram
h	hour
Hz	hertz
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
k	kilo
kHz	kilohertz
kPa	kilopascal
l	litre
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
mW	milliwatt
NaCl	sodium chloride
Ω	ohm
pF	picofarad
s	second
V	volt
W	watt

3.3 Abbreviations

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

AGC	Automatic Gain Control
DC	Direct Current
DSC	Digital Selective Calling
EMC	ElectroMagnetic Compatibility
emf	electromotive force
EUT	Equipment Under Test
FSK	Frequency Shift Keying
ISO	International Standards Organization
ITU	International Telecommunications Union
MF	Medium Frequency
MF/HF	Medium and High Frequency
MMS	Maritime Mobile Service
PEP	Peak Envelope Power
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
RMS	Root Mean Square
SINAD	Signal plus Noise plus Distortion to Noise plus Distortion
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

The equipment shall contain either:

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

Or:

- a dedicated DSC controller interface.

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;

b) receivers:
   - SSB Telephony:
     - 600 Ω earth free audio output;
     - earphone output;
     - speaker output.

4.2.2.1.2 DSC Interface

If the equipment does not have an integrated DSC controller then, the equipment shall have a dedicated interface for an external DSC controller compliant with EN 300 338-4 [4].

4.2.2.1.3 Digital input panels

Where a digital input panel with the digits "0" to "9" is provided, the digits shall be arranged to conform to ITU-T Recommendation E.161 [i.3]. However, where an alphanumeric keyboard layout is provided, the digits "0" to "9" may, alternatively, be arranged to conform to ISO 3791 [3].

4.2.2.2 Construction

The attention of the manufacturer is drawn to EN 60945 [i.6] 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 h 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 1 606,5 kHz and 4 000 kHz allocated in the ITU Radio Regulations [1] 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 [1] 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 min 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.

4.2.5.7 DSC operation

The radio shall have either an integrated DSC controller or a dedicated interface for an external DSC controller.

In either case the operation of the DSC controller and radio combination shall comply with all the requirements of EN 300 338-4 [4] for Class E DSC.

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 [2], 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 1.

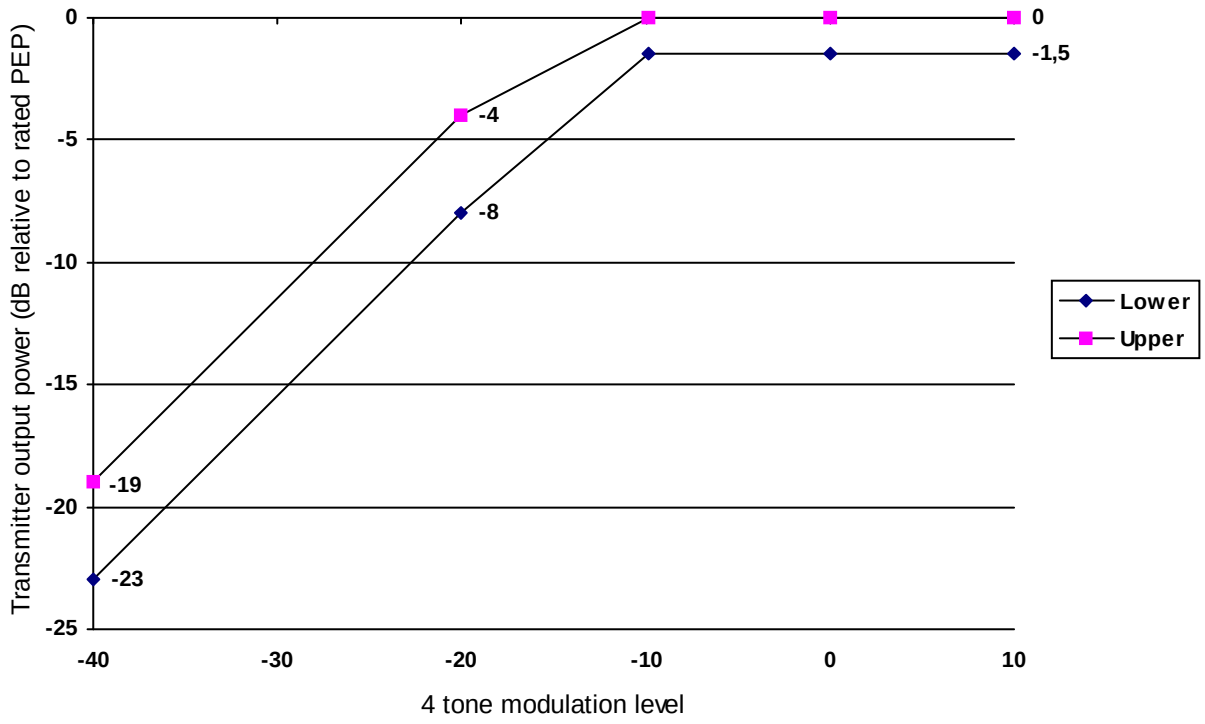


Figure 1: Limits of telephony level control

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

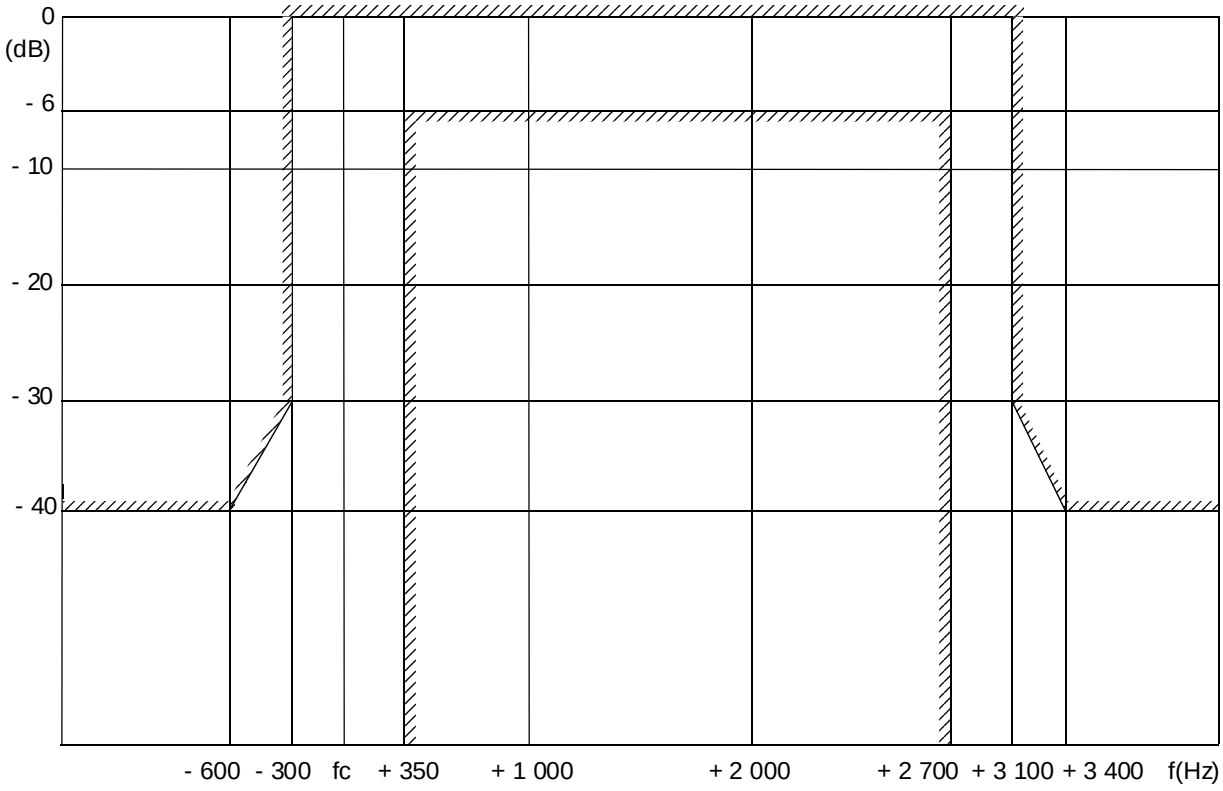
4.4.4.1 Definition

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 2 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 2.



Audio frequency response

Figure 2: 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 [2], 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 1 606,5 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 1 606,5 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 min 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 [i.4] 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.

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 +17dBµV 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 min 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 h. 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 h.

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

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

The equipment shall be subjected to a performance check during the 2 h 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 h. The equipment shall then be exposed to normal room temperature and humidity for not less than 3 h 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 h.

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 min.

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

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

The temperature of the chamber shall be maintained at +55 °C (±3 °C) during the 2 h 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 h. The equipment shall then be exposed to normal room temperature and humidity for not less than 3 h 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 h (±0,5 h), 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 h.

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

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

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 h 30 min 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 h. The equipment shall then be exposed to normal room temperature and humidity for not less than 3 h, or until moisture has dispersed, whichever 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 h.

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 min.

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 h. The equipment shall then be exposed to normal room temperature for not less than 3 h, or until moisture has dispersed, whichever 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 h.

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 min (±5 min).

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

The equipment shall be subjected to a performance check during the last 30 min 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 h. The temperature shall then be exposed to normal room temperature for not less than 3 h, or until moisture has dispersed, whichever 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 h.

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 m above the nozzle;
- test duration: 30 min;
- 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 [2], 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 1 606,5 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 1 606,5 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 [2], 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 1 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 [2], 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 [2], 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 [2], 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 min.

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 min. 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 [2], 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 min.

The test shall be performed on 2 182 kHz if the equipment is designed to operate in the 1 606,5 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 1 606,5 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): HS Requirements and conformance Test specifications Table (HS-RTT)

The HS Requirements and conformance Test specifications Table (HS-RTT) in table A.1 serves a number of purposes, as follows:

- it provides a statement of all the requirements in words and by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it provides a statement of all the test procedures corresponding to those requirements by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it qualifies each requirement to be either:
  - Unconditional: meaning that the requirement applies in all circumstances; or
  - Conditional: meaning that the requirement is dependant on the manufacturer having chosen to support optional functionality defined within the schedule.
- in the case of Conditional requirements, it associates the requirement with the particular optional service or functionality;
- it qualifies each test procedure to be either:
  - Essential: meaning that it is included with the Essential Radio Test Suite and therefore the requirement shall be demonstrated to be met in accordance with the referenced procedures;
  - Other: meaning that the test procedure is illustrative but other means of demonstrating compliance with the requirement are permitted.

Table A.1: HS Requirements and conformance Test specifications Table (HS-RTT)

Harmonized Standard EN 300 373-3 The following requirements and test specifications are relevant to the presumption of conformity under the article 3.3(e) of the R&TTE Directive						
Requirement			**Requirement Conditionality**		**Test Specification**	
No	**Description**	**Reference: Clause No**	**U/C**	**Condition**	**E/O**	**Reference: Clause No**
1	General, operational and technical requirements	4.2	U		X	
2	Vibration	4.3.1	U		E	5.3.1.4
3	Dry heat	4.3.2.2.2	C	Internally mounted equipment	E	5.3.1.5.1.1
4	Dry heat	4.3.2.2.2	C	Externally mounted equipment	E	5.3.1.5.1.2
5	Damp heat	4.3.2.3.2	U		E	5.3.1.5.2
6	Low temperature	4.3.2.4.2	C	Internally mounted equipment	E	5.3.1.5.3.1
7	Low temperature	4.3.2.4.2	C	Externally mounted equipment	E	5.3.1.5.3.2
8	Corrosion	4.3.3.2	U		E	5.3.1.6
9	Rain	4.3.4.2	C	Equipment mounted above deck	E	5.3.1.7
10	Unwanted frequency modulation	4.4.1	U		E	5.3.2.1

Harmonized Standard EN 300 373-3 The following requirements and test specifications are relevant to the presumption of conformity under the article 3.3(e) of the R&TTE Directive						
Requirement			**Requirement Conditionality**		**Test Specification**	
No	**Description**	**Reference: Clause No**	**U/C**	**Condition**	**E/O**	**Reference: Clause No**
11	Sensitivity of the microphone and the 600 Ω line inputs for SSB telephony	4.4.2	U		E	5.3.2.2
12	Automatic level control and/or limiter for SSB telephony	4.4.3	U		E	5.3.2.3
13	Audio frequency response of SSB telephony	4.4.4	U		E	5.3.2.4
14	Residual hum and noise power for telephony	4.4.5	U		E	5.3.2.5
15	Residual frequency modulation on DSC	4.4.6	U		E	5.3.2.6
16	Continuous operation of telephony	4.4.7	U		E	5.3.2.7
17	Protection of transmitter	4.4.8	U		E	5.3.2.8
18	Receiver frequency error	4.4.9	U		O	5.4.2
19	Unwanted frequency modulation	4.4.10	U		O	5.4.3
20	Pass band	4.4.11	U		O	5.4.4
21	Reciprocal mixing	4.4.12	U		O	5.4.5
22	Harmonic content in output	4.4.13	U		O	5.4.6
23	Audio frequency intermod	4.4.14	U		O	5.4.7
24	Internally generated spurious signals	4.4.15	U		O	5.4.8
25	AGC efficiency	4.4.16	U		O	5.4.9
26	AGC time constants	4.4.17	U		O	5.4.10
27	Protection of input circuits	4.4.18	U		O	5.4.11

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement or its test specification.

Description A textual reference to the requirement.

Clause Number Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is to be *unconditionally* applicable (U) or is *conditional* upon the manufacturers claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement shall or shall not be applicable for a technical requirement which is classified "conditional".

Test Specification:

E/O Indicates whether the test specification forms part of the Essential Radio Test Suite (E) or whether it is one of the Other Test Suite (O).

NOTE: All tests whether "E" or "O" are relevant to the requirements. Rows designated "E" collectively make up the Essential Radio Test Suite; those designated "O" make up the Other Test Suite; for those designated "X" there is no test specified corresponding to the requirement. The completion of all tests classified "E" as specified with satisfactory outcomes is a necessary condition for a presumption of conformity. Compliance with requirements associated with tests classified "O" or "X" is a necessary condition for presumption of conformity, although conformance with the requirement may be claimed by an equivalent test or by manufacturer's assertion supported by appropriate entries in the technical construction file.

Clause Number Identification of clause(s) defining the test specification in the present document unless another document is referenced explicitly. Where no test is specified (that is, where the previous field is "X") this field remains blank.

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

The enlargement of the European Union (EU) resulted in a requirement from the EU for a larger number of languages for the translation of the titles of Harmonized Standards and mandated ENs that are to be listed in the Official Journal to support the implementation of this legislation.

For this reason the title translation concerning the present document can be consulted via the e-approval application.

Annex C (informative): Bibliography

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

History

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