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Radio Equipment and Systems (RES); Technical characteristics and methods of measurement for maritime radiotelephone watch receivers for the distress and calling frequency 2 182 kHz

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Foreword

This final draft European Telecommunication Standard (ETS) has been produced by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Voting phase of the ETSI standards approval procedure.

Proposed transposition dates	
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1 Scope

This ETS states the minimum requirements for maritime radiotelephone watch receivers, including power supply units or converters, intended for keeping watch on the international distress and calling frequency 2 182 kHz.

This ETS is intended to cover equipment installed below deck in accordance with the requirement of the International Maritime Organization (IMO) [2].

This ETS includes the relevant provisions of the Radio Regulations [1] and of the International Maritime Organization [2].

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ITU Radio Regulations.

[2] International Convention for Safety of Life at Sea, as amended 1988.

[3] ISO Recommendation 694 Method B.

[4] ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[5] ITU-R Recommendation 332-4: "Selectivity of receivers".

3 Abbreviations and symbols

3.1 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

AGC	Automatic Gain Control
emf	electromotive force
EPIRB	Emergency Position-Indicating Radio Beacon
IMO	International Maritime Organization
SND/N	Signal + Noise + Distortion/Noise

3.2 Symbols

For the purposes of this ETS, the following symbols apply:

A2A	Double sideband, single channel containing quantized or digital information with the use of a modulating sub-carrier, telegraphy.
H2A	Single sideband with full carrier single channel containing quantized or digital information with the use of a modulating sub-carrier, telegraphy.
A3E	Double sideband, single channel containing analogue information, telephony.
H3E	Single sideband, full carrier, single channel containing analogue information, telephony.

4 General requirements

4.1 Construction

4.1.1 Equipment elements

The equipment shall comprise the following elements:

- a receiver;

- a loudspeaker;

- a filtering unit and/or a muting device to silence the loudspeaker in the absence of any of the signals stated in clause 8;

- optionally, a device may be provided for disconnecting the filter, muting device or both during the periods of radiotelephone silence.

4.1.2 Design

In all respects the mechanical and electrical design, construction and finish of the equipment shall conform with good engineering practice, and the equipment shall be suitable for use on board ships at sea.

4.1.3 Inspection and maintenance

All parts of the equipment which are subject to inspection and maintenance adjustments shall be easily accessible. Components shall be easily identifiable, either by markings within the equipment or with the aid of the technical description.

The equipment shall be so designed that the main units can be replaced readily, without elaborate recalibration or readjustment.

4.1.4 Illumination

Means shall be provided for reducing, to extinction, the output of any light source on the equipment.

4.1.5 Interfaces

Connection of, or failure within, any external circuits shall not degrade the performance of the equipment.

4.2 Controls and indicators

4.2.1 General

All controls, instruments, monitoring devices and input/output points shall be clearly labelled.

All controls shall be of sufficient size to enable the usual control functions to be easily performed.

4.2.2 Controls

Only the following controls shall be provided on the exterior of the equipment:

- on/off switch;

- volume control for adjusting the audio frequency power as described in subclause 7.1;

- control for reducing the brightness of light sources, as described in subclause 4.1.4;

- muting device control or controls where clause 8 applies;

- filter control where subclause 8.4 applies;

- control for disabling the automatic control as described in subclause 8.4;

- a manual switch to take the mute and/or filtering unit out of operation.

4.2.3 Indicators

The status of all the controls shall be clearly indicated.

4.2.4 Misuse

The equipment shall be so designed that the misuse of the controls shall not cause damage to the equipment or injury to personnel.

4.3 Labels

4.3.1 Power supply

Details of the power supply from which the equipment is intended to operate shall be clearly indicated on the equipment.

4.3.2 Identification

The equipment shall be clearly marked on the exterior with identification of the manufacturer, type designation of the equipment and serial number.

4.3.3 Compass safe distance

The compass safe distance according to ISO Recommendation 694 Method B [3] shall be declared by the manufacturer and marked on the equipment.

4.4 Safety precautions

4.4.1 Protection

Provisions shall be made for protecting the equipment from damage if the power supply is subjected to transient voltage changes and from damage by accidental reversal of the polarity of the power supply.

4.4.2 Earthing

Means shall be provided for earthing exposed metallic parts of the equipment, but this shall not cause any terminal of the source of energy to be earthed.

4.4.3 Antenna static protection

In order to provide protection against damage due to static voltage which may appear at the input of the receiver, there shall be a dc path from the antenna terminal to the chassis not exceeding 100 kΩ.

4.4.4 Access

All parts and wiring in which the direct or alternating voltages or both combine to give a peak voltage greater than 50 V, shall be protected against accidental access and shall be isolated automatically from all sources of electrical energy when the protective covers are removed.

Alternatively, the equipment shall be so constructed that access to such voltages may only be gained after having used a tool for this purpose, such as a spanner or a screwdriver, and warning labels shall be prominently displayed both within the equipment and on the protective covers.

4.5 Tuning

The receiver shall be fixed tuned on the frequency 2 182 kHz.

4.6 Classes of emission

The receiver shall be capable of receiving emissions of classes A2A, H2A, A3E and H3E.

4.7 Warming up period

The equipment shall meet the requirements of this ETS one minute after being switched on.

4.8 Instructions

Adequately detailed operation and maintenance instructions shall be provided with the equipment.

4.8.1 Repair instructions

If the equipment is so constructed that fault diagnosis and repair are practicable down to component level, the instructions shall include full circuit diagrams, component layouts and component parts lists.

If the equipment contains modules in which fault diagnosis and repair down to component level is not practicable, the instructions shall contain sufficient information to enable localisation and replacement of the defective module(s). With regard to other modules and components in the equipment, the instructions shall contain the information mentioned above.

4.8.2 Accessibility

All parts of the equipment which are subject to inspection and maintenance adjustments shall be easily accessible. Components shall be easily identifiable either by markings within the equipment or with the aid of technical description.

5 Test conditions, power supplies and ambient temperatures

5.1 General

Conformance testing shall be made under normal test conditions and also, where stated, under extreme test conditions.

5.2 Test power source

During the conformance tests, the equipment shall be supplied from a test power source capable of producing normal and extreme test voltages as specified in subclauses 5.3.2 and 5.4.2.

The voltage of the power source shall be measured at the input terminals of the equipment.

The test power source voltages shall be maintained within a tolerances of ± 3 % relative to the voltage at the beginning of the test.

5.3 Normal test conditions

5.3.1 Normal temperature and humidity

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

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

5.3.2 Normal test power source

5.3.2.1 Mains voltage and frequency

The normal test voltage for equipment to be connected to the ac mains shall be the nominal ac mains voltage. For the purpose of conformance testing, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment is designed.

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

5.3.2.2 Secondary battery power sources

When the equipment is designed for operation from a secondary battery power source, the normal test voltage shall be the nominal voltage of the battery (12 V, 24 V etc.).

5.3.2.3 Other power sources

When the equipment is designed for operation from other power sources, the normal test voltage shall be stated by the equipment manufacturer.

5.4 Extreme test conditions

5.4.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with subclause 5.5 at - 15ºC (± 3ºC) and at + 55ºC (± 3ºC).

5.4.2 Extreme values of the test power source

5.4.2.1 Mains voltage and frequency

The extreme test voltages for equipment to be connected to the ac mains shall be the nominal mains voltage ± 10 %. The frequency of the test power source shall be 50 Hz ± 1 Hz.

5.4.2.2 Secondary battery power sources

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

5.4.2.3 Other power sources

When the equipment is designed for operation from other power sources, the extreme test voltages shall be stated by the manufacturer.

5.5 Procedures for tests at extreme temperatures

The equipment shall be placed in the test chamber at normal temperature. The maximum rate of raising or reducing the temperature of the chamber shall be 1ºC/min. The equipment shall be switched off during the temperature stabilising periods. 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.

Before conducting tests at extreme temperatures, the equipment in the test chamber shall have reached thermal balance and be subjected to the extreme temperature for a period of between 10 hours and 16 hours.

For tests at the lower extreme temperature, the equipment shall be switched on to standby or receive condition for one minute before measurements are performed.

For tests at the higher extreme temperature, the equipment shall be switched on for half an hour before measurements are performed.

The temperature of the chamber shall be maintained at the extreme temperatures for the whole duration of the performance test.

At the end of the test, with the equipment still in the chamber, the chamber shall be brought to normal temperature in not less than one hour. The equipment shall then be exposed to normal temperature and humidity for not less than three hours or until moisture has dispersed, whichever is the longer, before the next test is carried out. Alternatively, observing the same precautions, the equipment may be returned directly to the conditions required for the start of the next test.

5.6 Artificial antenna

For the purpose of conformance testing, the receiver shall meet the requirements of this ETS when an artificial antenna consisting of a resistance of 10 Ω in series with a capacitance of 250 pF is connected as described in subclause 5.7.

This shall in no way imply that the receiver shall work only with antennas having that characteristic.

5.7 Test signals applied to the receiver input

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 antenna specified in subclause 5.6. This requirement shall be met irrespective of whether one 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.

The levels of the input signals shall be expressed in terms of the emf that exists at the output terminals of the signal sources including the associated network.

5.8 Measurement uncertainty and interpretation of the measuring results

5.8.1 Measurement uncertainty

Table 1: Absolute measurement uncertainties

Parameter:	Maximum values:
Audio output power	± 0,5 dB
Sensitivity	± 3 dB
Conducted emission	± 3 dB
Two signal measurement	± 4 dB

For the test methods according to this ETS the uncertainty figures are valid to a confidence level of 95 % calculated according to the methods described in ETR 028 [4].

5.8.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in this ETS 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 ETS;

- the measurement uncertainty value 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 1.

6 Environmental tests

6.1 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.

6.2 Procedure

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

Unless otherwise stated, the equipment shall be connected to an electrical power source only during the periods for which it is specified that electrical tests shall be carried out.

These tests shall be done with normal test voltage.

6.3 Performance check

For the purpose of this ETS, the term performance check shall be taken to mean a check of the receiver sensitivity:

- a class A2A signal on the frequency 2 182 kHz, modulated at 1 kHz with a modulation factor of 30 % shall be applied to the receiver input. The level of the input signal shall be adjusted so that a SND/N ratio of 10 dB is obtained and at the same time, 500 mW of power is provided at the output. The level of the input signal shall be measured;

- the level of the input signal shall be lower than + 20 dBμV (emf).

6.4 Vibration test

6.4.1 Method of measurement

The equipment shall be clamped to the vibration table by its normal means of support and in its normal operating position.

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 field due to the vibration table.

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

- 5 Hz and 12,5 Hz with an excursion of ± 1,6 mm ± 10 %;

- 12,5 Hz and 25 Hz with an excursion of ± 0,38 mm ± 10 %;

- 25 Hz and 50 Hz with an excursion of ± 0,10 mm ± 10 %.

A resonance search shall be carried out during the vibration test. If resonance of any part of any component is observed, the equipment shall be subjected to vibration endurance test at each resonance frequency with the duration of not less than two hours at the vibration level specified above.

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 during the test.

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

6.4.2 Requirement

The limit of the performance check shall be met.

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

6.5 Damp heat test

6.5.1 General

The maximum rate of raising or reducing the temperature of the chamber in which the equipment is being tested shall be 10°C/min.

6.5.2 Method of measurement

The equipment shall be placed in a chamber at normal room temperature and humidity which, steadily, over a period of three hours (± 30 minutes), 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 minutes later the equipment shall be switched on, and shall then be kept working continuously for a period of two hours.

The equipment shall be subjected to a performance check during the two 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 and 30 minutes 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 one hour. The equipment shall then be exposed to normal room temperature and humidity for not less than three hours, or until moisture has dispersed, which ever is longer, before the next test is carried out.

6.5.3 Requirement

The limit of the performance check shall be met.

7 Receiver

7.1 Audio frequency output power

7.1.1 Definition

The audio frequency output power of the receiver is the available power in the loudspeaker.

7.1.2 Method of measurement

The standard output power of the receiver shall be measured at a frequency of 1 kHz in a resistance equal to the modulus of the impedance of the loudspeaker.

7.1.3 Limit

The standard output power used in this ETS shall be 50 mW.

The rated output power stated by the manufacturer shall be at least 500 mW.

7.2 Maximum usable sensitivity

7.2.1 Definition

The maximum usable sensitivity is the minimum level of a radio frequency signal with specified modulation, which produces at the receiver output a chosen value of the signal-noise-distortion to noise ratio (SND/N) and, at the same time, an output power at least equal to a specified value.

7.2.2 Method of measurement

A class A2A signal on the frequency 2 182 kHz, modulated at 1 kHz with a modulation factor of 30 % shall be applied to the receiver input. The level of the input signal shall be adjusted so that a SND/N ratio of 10 dB is obtained and at the same time, 500 mW of power is provided at the output. The level of the input signal shall be measured.

Measurements shall be made under normal and extreme test conditions (subclauses 5.4.1 and 5.4.2 applied simultaneously).

7.2.3 Limit

The maximum usable sensitivity shall be better than + 20 dBμV (emf).

7.3 Audio frequency pass band

7.3.1 Definition

The audio frequency pass band is the frequency band at the output of the receiver within which the attenuation relative to the maximum level does not exceed 6 dB.

7.3.2 Method of measurement

An A2A signal with a level of + 60 dBμV, modulated to a depth of 30 % at 1 kHz shall be applied to the receiver input and the receiver shall be adjusted to give standard output power. The modulation frequency shall then be varied from 10 Hz to 10 kHz, maintaining a constant modulation depth of 30 % and the output level corresponding to each modulation frequency shall be measured at a sufficient number of points to enable the audio frequency pass band to be determined.

7.3.3 Limits

The audio frequency pass band shall be at least 350 Hz to 2,7 kHz.

The attenuation relative to the peak response shall be at least 20 dB at 6 kHz.

7.4 Adjacent signal selectivity

7.4.1 Definition

The adjacent signal selectivity of the receiver is the ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals simultaneously in channels adjacent to that of the wanted signal. For the purpose of this ETS, the adjacent signal selectivity is defined as the ratio of the signal levels at the receiver input which results in a reduction in the SND/N ratio from 20 dB to 14 dB.

7.4.2 Method of measurement

The arrangements for applying two test signals to the receiver input, shall be according to subclause 5.7. The automatic gain control of the equipment shall be in operation. The wanted test signal shall be an A2A signal at 2 182 kHz, modulated to a depth of 30 % at 1 kHz.

The receiver shall be adjusted to give standard output power at a SND/N ratio of 20 dB.

An unwanted A2A signal at a frequency shown in table 2, modulated to a depth of 30 % at 400 Hz, shall additionally be applied to the receiver input. Starting from a low level, this signal shall be increased until the SND/N ratio is decreased from 20 dB to 14 dB.

7.4.3 Limits

The adjacent signal selectivity shall not be less than the values given in table 2.

Table 2: Adjacent channel selectivity limits

Frequency of unwanted signal relative to 2 182 kHz	Adjacent signal selectivity
- 10 kHz and + 10 kHz	40 dB
- 20 kHz and + 20 kHz	50 dB

7.5 Blocking

7.5.1 Definition

Blocking is a change (generally a reduction) in the wanted output power of a receiver or a reduction in the SND/N ratio, due to an unwanted signal on another frequency.

7.5.2 Method of measurement

The test shall be carried out with the automatic gain control operative. The measurement shall be made by means of 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 is the unwanted signal.

The wanted signal shall be an A2A signal with a carrier frequency of 2 182 kHz, modulated to a depth of 30 % at 1 kHz.

Measurements shall be carried out with an input level of the wanted signal of + 60 dBμV and repeated with a level equal to the maximum usable sensitivity of the receiver as measured in subclause 7.2.

The receiver shall be adjusted so that the wanted signal gives standard output power (subclause 7.1).

The unwanted signal shall be unmodulated and shall have a frequency of ± 20 kHz relative to that of the wanted signal.

The input level of the unwanted signal shall be adjusted until either it causes a change of 3 dB in the output level of the wanted signal or until it causes a reduction in the SND/N ratio of 6 dB, whichever occurs first. The input level of the unwanted signal when the specified condition is reached, shall be taken as the blocking level.

7.5.3 Limits

With the wanted signal at + 60 dBμV, the blocking level shall not be less than 100 dBμV.

With the wanted signal at the measured maximum usable sensitivity level, the blocking level shall be at least + 65 dB above the measured usable sensitivity.

7.6 Cross modulation

7.6.1 Definition

Cross modulation is the transfer of modulation from an unwanted, modulated signal on an another frequency to the wanted signal.

7.6.2 Method of measurement

The test shall be carried out with the automatic gain control operative. The measurement shall be made by means of 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 is the unwanted signal.

The wanted signal shall be an A2A signal with a carrier frequency of 2 182 kHz, modulated to a depth of 30 % at 1 kHz.

Measurements shall be carried out with an input level of the wanted signal of + 60 dBμV.

The receiver shall be adjusted so that the wanted signal gives standard output power (subclause 7.1).The modulation of the wanted signal shall be switched off.

The unwanted signal shall have a frequency of ± 20 kHz relative to that of the wanted signal and be modulated to a depth of 30 % at 400 Hz. The input level of the unwanted signal shall be increased until total unwanted power in the receiver output due to cross modulation is 30 dB below the standard output power.

The input of the unwanted signal at which this condition is reached is the cross modulation level.

7.6.3 Limit

The cross modulation level shall not be less than + 90 dBμV.

7.7 Inter-modulation

7.7.1 Definition

Inter-modulation is a process by which signals are produced from two or more (generally unwanted) signals simultaneously present in a non-linear circuit.

7.7.2 Method of measurement

With the automatic gain control operative, an A2A test signal at the carrier frequency 2 182 kHz modulated to a depth of 30 % at 1 kHz shall be applied to the receiver input at a level of + 30 dBμV, and the audio frequency gain control shall be adjusted to give standard output power. The audio frequency gain control shall not be adjusted during the remainder of this test. The wanted signal shall then be removed and the two unwanted signals shall be simultaneously applied to the input of the receiver. The signal nearest to the wanted signal frequency shall be unmodulated. The other unwanted signal shall be an A2A signal modulated to a depth of 30 % at 1 kHz.

Neither of the two signals shall have a frequency within 30 kHz from the wanted signal (input frequencies likely to cause unwanted inter-modulation products are mentioned in ITU-R Recommendation 332-4, section 6.4 [5]). When choosing the frequencies used for this measurement, care should be taken to avoid frequencies at which spurious responses occur. The input levels of the two interfering signals shall remain equal and shall be adjusted until the output power of the receiver due to the interfering signals is equal to the standard output power.

7.7.3 Limit

The level of either of the two interfering signals which results in standard output power shall not be less than + 80 dBμV.

7.8 Spurious response rejection ratio

7.8.1 Definition

The spurious response rejection ratio is the ratio of the input level of an unwanted signal at the frequency of the spurious response, to the input level of a wanted signal, when the wanted and unwanted signals individually produce the same SND/N ratio at the receiver output.

7.8.2 Method of measurement

An A2A test signal at the carrier frequency 2 182 kHz, modulated to a depth of 30 % at 1 kHz shall be applied to the receiver input at a level such that a SND/N ratio of 10 dB is produced.

The carrier frequency of the input signal shall then be varied between 100 kHz and 2 GHz to search for spurious responses. For each spurious response found, the carrier frequency of the input signal shall be adjusted to give maximum output power. The input level shall then be adjusted to give a SND/N ratio of 10 dB at the output of the receiver. The ratio between the input level of each spurious signal and the input level of the wanted signal shall then be evaluated.

7.8.3 Limit

All spurious response rejection ratios shall be not less than 60 dB.

7.9 Harmonic distortion

7.9.1 Definition

The harmonic distortion at the output of the receiver is defined as the percentage of the total rms voltage of all harmonic components of the modulating audio frequency to the total rms voltage of the signal delivered by the receiver.

7.9.2 Method of measurement

An A2A test signal at the carrier frequency 2 182 kHz modulated to a depth of 30 % at 1 kHz shall be applied to the receiver input and its level shall be set in turn to + 40 dBµV and + 80 dBµV. The audio frequency gain control shall be set to give rated output power. At each setting of input level the modulation depth shall be increased from 30 % to 80 % and the audio gain control used to maintain the output level at rated output power.

7.9.3 Limit

At a modulation depth of 30 % the harmonic distortion shall not exceed 10 %.

At a modulation depth of 80 % the harmonic distortion shall not exceed 15 %.

7.10 Conducted spurious emissions

7.10.1 Definition

Conducted spurious emissions are emissions at any frequency conducted into the antenna or artificial antenna.

7.10.2 Method of measurement

Conducted spurious emissions shall be measured across the resistive part of the artificial antenna specified in subclause 5.6.

The measurement shall be carried out within the frequency range 9 kHz - 2 GHz using a spectrum analyzer or a frequency selective measuring instrument. The resolution bandwidth of the spectrum analyzer or the frequency selective measuring instrument shall be set to 200 Hz for the frequency range 9 kHz to 150 kHz, 10 kHz for the frequency range 150 kHz to 30 MHz and 100 kHz for the frequency range 30 MHz to 2 GHz.

7.10.3 Limits

The power of any discrete component measured in the artificial antenna shall not exceed 2 nW.

7.11 Automatic gain control

An automatic gain control capable of satisfactory operation shall be provided.

NOTE: The receiver should be designed to prevent excessive noise at the receiver output in the absence of input signals.

7.11.1 Methods of measurement

a) to test the AGC at low input signal levels, an A2A test signal at the carrier frequency 2 182 kHz modulated to a depth of 30 % at 1 kHz, shall be applied to the receiver input. The input level shall be adjusted to give a SND/N ratio of 10 dB. The volume control shall be adjusted to give standard output power. The input level shall then be increased by 20 dB and the SND/N ratio shall be measured;

b) to test the AGC at high input signal levels, an A2A test signal at the carrier frequency 2 182 kHz modulated to a depth of 30 % at 1 kHz, shall be applied to the receiver input. The input level shall be adjusted to give a SND/N ratio of 10 dB. The volume control 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 and the change in output power shall be measured.

7.11.2 Limits

a) under the test conditions specified in subclause 7.11.1 a), the SND/N ratio shall increase to at least 25 dB;

b) under the test conditions specified in subclause 7.11.1 b), the output power shall not increase by more than 10 dB.

7.12 Audio frequency gain controls

7.12.1 Definition

The audio frequency gain control is a manual volume control by which the audio output can be varied between the maximum level and a low but audible level.

7.12.2 Method of measurement

It shall be possible with a pre-set control not readily accessible to the operator, to adjust the low output level. Any combined setting of the manual and pre-set volume controls shall not give an output power of less than 1 mW at the usable sensitivity level as measured in accordance with subclause 7.2.

7.12.3 Limit

With the manual volume control at minimum position the pre-set control shall allow for a range of output power of at least 12 dB.

7.13 Protection of input circuits

7.13.1 Definition

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

Provisions shall be made for protecting the receiver and muting its output when the ship's own radiotelephone transmitter is radiating on 2 182 kHz.

7.13.2 Method of measurement

The receiver shall not suffer damage when an unmodulated radio frequency test signal of 30 V rms is applied to its input as specified in subclause 5.7 for a period of 15 minutes at any frequency in the range 100 kHz to 28 MHz.

7.13.3 Limit

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

8 Muting device

8.1 General

The equipment may be provided with a muting device to silence the loudspeaker until one of the following signals is received:

a) the radiotelephone alarm signal (subclause 8.2.2);

b) the signal preceding a vital navigation warning (subclause 8.2.3);

c) additionally, the muting device may also respond to EPIRB signals as defined in the Radio Regulations [1] provided that the signal consists of marks and spaces having a nominal duration of one second (see subclause 8.2.4).

On reception of either of the signals a) and b) and, where appropriate, signal c), the mute shall automatically be lifted and the equipment switched to the full audio pass band condition until manually reset.

If this device is provided it shall be possible to set the equipment to the mute condition and restore it to normal operation quickly and easily by means of a control available to the operator. A manual control shall also be provided for resetting the equipment to the mute condition after the mute has been lifted.

8.2 Mute response

8.2.1 Methods of measurement

With the muting device inoperative, an A2A test signal at the carrier frequency 2 182 kHz modulated to a depth of 30 % at 1 kHz, shall be applied to the receiver input at the measured sensitivity level. The volume control shall be set to obtain standard output power, after which the tests as described below shall be carried out with the mute set to the operative condition.

8.2.2 Response to the radiotelephone alarm signal

An A2A test signal modulated with the radiotelephone alarm signal to a modulation depth of 70 %, shall be applied to the receiver input. The level shall be below that necessary to lift the mute. The output power shall be measured whilst the level of the input test signal is increased until the output power rises to at least - 6 dB relative to the standard output power. The input level at which this occurs shall be recorded.

The test shall be repeated at all combinations of the permitted extremes of tolerances, as given below, to which the radiotelephone alarm signal may be subjected:

- frequency: 1 300 Hz $\pm$ 20 Hz, 2 200 Hz $\pm$ 35 Hz;

- duration of tones: 250 ms $\pm$ 50 ms;

- spacing between tones: 0 to 50 ms.

8.2.3 Response to the navigational warning signal

An A2A test signal at the carrier frequency 2 182 kHz modulated with a navigational warning signal to a depth of 70 %, shall be applied to the receiver input. The level shall be below that necessary to lift the mute. The output power shall be measured whilst the level of the input test signal is increased, until the output power rises to at least - 6 dB relative to standard output power. The input level at which this occurs shall be recorded.

The test shall be repeated at all combinations of the limits given below:

- modulation frequency: 2 200 Hz $\pm$ 35 Hz;

- modulation on: 250 ms $\pm$ 50 ms;

- modulation off: 250 ms ± 50 ms.

8.2.4 Response to the 1 300 Hz EPIRB signal

An A2A test signal at the carrier frequency 2 182 kHz modulated to a depth of 30 % at 1 300 Hz and having a pulse sequence of one second signal followed by one second no signal shall be applied to the receiver input. The level shall be below that necessary to lift the mute. The output power shall be measured whilst the level of the input test signal is increased until the output power rises to at least - 6 dB relative to standard output power.

The input level at which this occurs shall be recorded.

The test shall be repeated at all combinations of the limits given below:

- modulation frequency: 1 300 Hz ± 20 Hz;

- modulation and carrier on: 1,0 s - 1,2 s;

- modulation and carrier off: 1,0 s - 1,2 s; and

omitting those combinations resulting in mark/space ratios below 1/1.

8.2.5 Limit

The mute shall be lifted within a period not greater than six seconds at input levels equal to and higher than the measured sensitivity level.

8.3 Protection against unwanted signals

8.3.1 Method of measurement

The receiver shall be adjusted in accordance with subclause 8.2.1, after which the tests as described below shall be carried out with the mute set to the operative condition.

8.3.1.1 Selective calling signals on 2 170,5 kHz

An A2A test signal at the carrier frequency 2 170,5 kHz with a duration of at least 10 seconds modulated to a depth of 70 % shall be applied to the receiver input at a level of 70 dB above the measured sensitivity level. The modulation frequency shall alternate between 1 275 Hz and 2 110 Hz, each pulse having a duration of 100 ms. The output power shall be measured.

The measurement shall be repeated with modulating frequencies 1 358 Hz and 2 110 Hz.

8.3.1.2 Speech modulation

A speech signal at the frequency 2 182 kHz and with a level 70 dB above the measured sensitivity level shall be applied to the input of the receiver for a duration of five minutes. The output power shall be measured.

8.3.1.3 Non-specific 2 200 Hz signals

An A2A signal, at the carrier frequency of 2 182 kHz modulated to a depth of 70 % shall be applied to the receiver input at a level of 70 dB above the measured sensitivity level. The modulation frequency shall be 2 200 Hz ± 35 Hz and shall be pulsed using all combinations of the following:

a) modulation on:

   - 175 ms or less;
   - 325 ms or greater;

   modulation off:

- 250 ms;

b) modulation off:

- 175 ms or less;
- 325 ms or greater;

modulation on:

- 250 ms.

8.3.2 Limits

The output power due to modulation shall not exceed 30 dB below the standard output power.

8.4 Operation during radiotelephone silence periods

If a device as defined in subclause 4.1.1 is applicable, the equipment shall automatically switch to the full audio pass band condition for the duration of the radiotelephone silence periods by connection to a clock or by other approved means. A control shall be provided to enable this facility to be taken out of operation at any time.

8.5 Provisions for testing

Provisions shall be made to enable routine testing of the muting device by using a two-tone alarm signal generator which may be a separate device.

History

Document history			
September 1994	Public Enquiry	PE 70:	1994-09-05 to 1994-12-30
December 1995	Vote	V 93:	1995-12-11 to 1996-02-02