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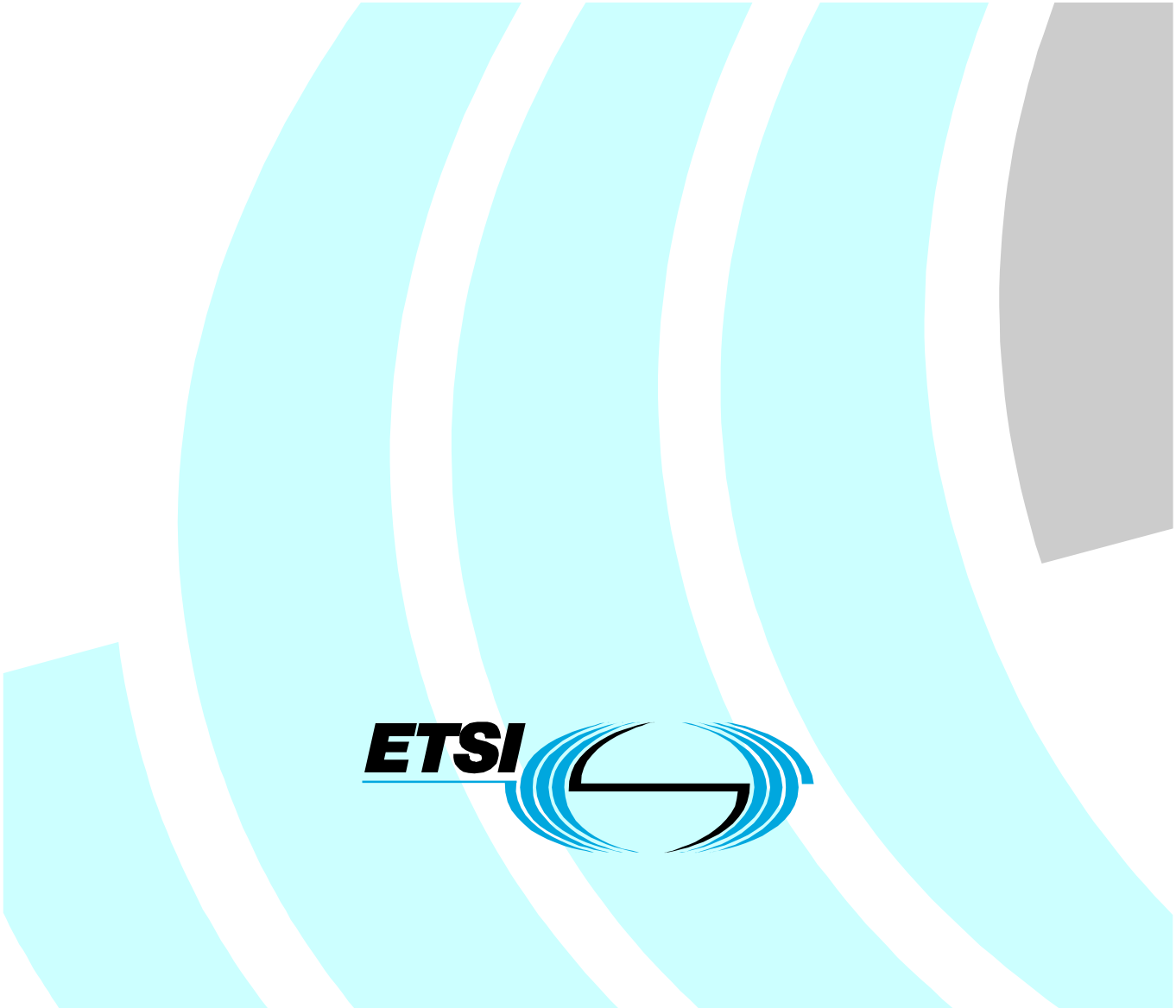
Candidate Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Maritime mobile transmitters and receivers for use in the MF and HF bands; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive



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Contents

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Foreword

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

The present document is part 2, 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".

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC [8] laying down a procedure for the provision of information in the field of technical standards and regulations.

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

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):	36 months after doa

Introduction

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

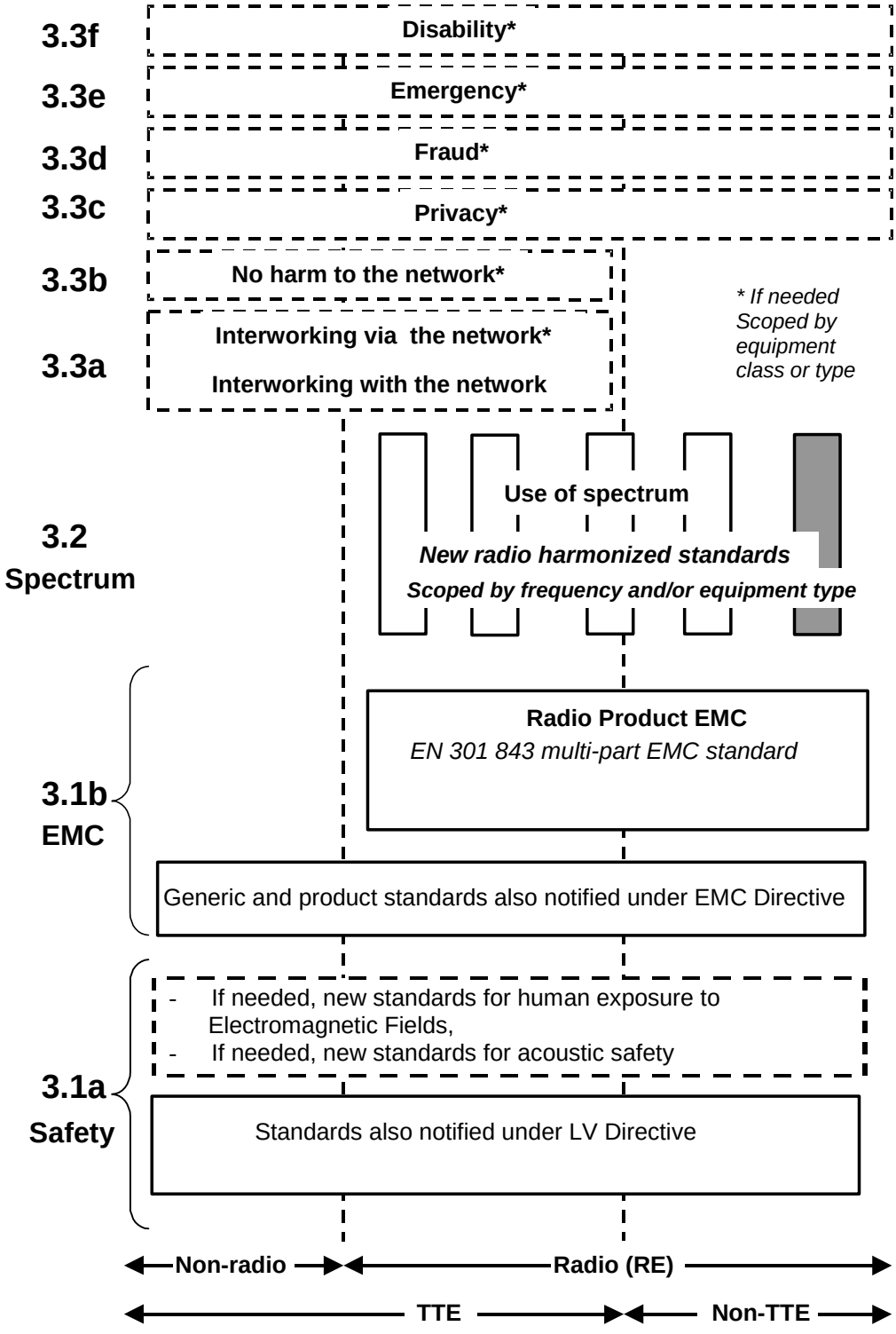


Figure 1: Modular structure for the various standards used under the R&TTE Directive

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

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

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

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

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

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

The modularity principle has been taken because:

- it minimizes the number of standards needed. Because equipment may, in fact, have multiple interfaces and functions it is not practicable to produce a single standard for each possible combination of functions that may occur in an equipment;
- it provides scope for standards to be added:
  - under article 3.2 when new frequency bands are agreed; or
  - under article 3.3 should the Commission take the necessary decisions

  without requiring alteration of standards that are already published;
- it clarifies, simplifies and promotes the usage of Harmonized Standards as the relevant means of conformity assessment.

1 Scope

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

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

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

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

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

The present document is intended to cover the provisions of Directive 1999/5/EC (R&TTE Directive) [1] article 3.2, which states that "….. radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

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

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

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

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive [1] will apply to equipment within the scope of the present document.

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

2 References

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

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

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

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

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

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

[4] ITU Radio Regulations (2001).

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

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

[7] ETSI TR100 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[8] 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.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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

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

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

spurious emission: emission on a frequency, or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of-band emissions (ITU Radio Regulations [4]).

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 Radio Regulations [4] and the following apply:

dBA	dB relative to 2 x 10^{-5} Pascal
dBd	antenna gain relative to a half-wave dipole
dBuV	dB relative to 1 microvolt emf
dBuV/m	dB relative to 1 microvolt per metre
F1B	frequency modulation, single channel containing quantized or digital information without the use of a modulating sub-carrier, telegraphy for automatic reception
J2B	SSB, suppressed carrier, single channel containing quantized or digital information with the use of a modulating sub-carrier, telegraphy for automatic reception
J3E	SSB, suppressed carrier, single channel containing analogue information, telephony

3.3 Abbreviations

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

AGC	Automatic Gain Control
Bd	Baud
BER	Bit Error Rate
DC	Direct Current
DSC	Digital Selective Calling
EMC	Electro-Magnetic Compatibility
emf	electromotive force
FSK	Frequency Shift Keying
IF	Intermediate Frequency
ITU	International Telecommunications Union
LV	Low Voltage
MF	Medium Frequency
MF/HF	Medium and High Frequency
MMS	Maritime Mobile Service
NBDP	Narrow Band Direct Printing telegraphy
PEP	Peak Envelope Power
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
SINAD	Signal + Noise + Distortion / Noise + Distortion
SSB	Single SideBand

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 Conformance requirements

4.2.1 Frequency error

4.2.1.1 Definition

The frequency error of the transmitter is defined as:

a) for SSB telephony:

- the difference between the measured frequency less 1 000 Hz and the nominal value of the frequency for the particular telephony channel.

b) for DSC with an analogue interface:

- the difference between the measured and the nominal assigned frequency.

c) for DSC with a digital interface:

- the difference between the measured Y-state frequency and the nominal assigned frequency -85 Hz and the difference between the measured B-state frequency and the nominal assigned frequency +85 Hz.

4.2.1.2 Limits

The transmitter frequencies shall, after the warming-up period specified in clause 5.1.7 be within ±10 Hz of the frequencies calculated in accordance with the definitions in clause 4.2.1.1.

4.2.1.3 Conformance

Conformance tests as described in clause 5.3.1 shall be carried out.

4.2.2 Output power and intermodulation products

4.2.2.1 Definition

The output power is the value of peak envelope power delivered by the transmitter to the artificial antenna in telephony SSB mode or the value of the mean power delivered by the transmitter to the artificial antenna in DSC mode.

NOTE: The measurement of intermodulation products characterizes the linearity of amplitude modulated transmitters and is defined in ITU-R Recommendation SM 326-6 (see bibliography).

4.2.2.2 Limits

4.2.2.2.1 Output power in the range 1 605 kHz to 4 000 kHz for all modulation modes

The maximum peak envelope power or maximum mean power, as appropriate (see clause 4.2.2.1), shall be within ±1,5 dB of the manufacturer's declared value(s), shall be greater than 60 W and shall not exceed 400 W.

4.2.2.2.2 Output power in the range 4 MHz to 27,5 MHz for all modulation modes

The maximum peak envelope power or maximum mean power, as appropriate (see clause 4.2.2.1), shall be within ±1,5 dB of the manufacturer's declared value(s), shall be greater than 60 W, and shall not exceed 1 500 W.

4.2.2.2.3 Intermodulation products for SSB telephony modes

For equipment with a rated output power exceeding 250 W PEP the value of intermodulation products shall not exceed 25 dB below the highest of the two tones under normal test conditions and shall not exceed 22 dB below the highest of the two tones under extreme test conditions.

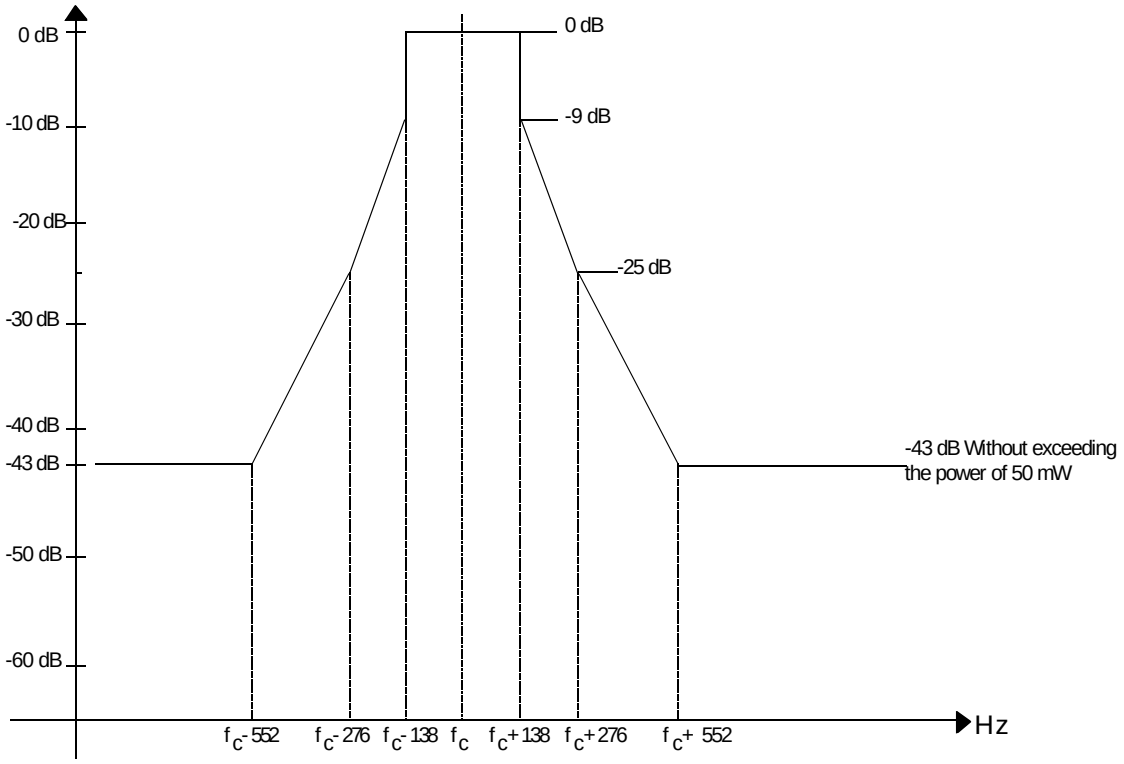
For equipment with a rated output power up to and including 250 W PEP the value of intermodulation products shall not exceed 22 dB below the highest of the two tones under normal test conditions and shall not exceed 19 dB below the highest of the two tones under extreme test conditions.

4.2.2.2.4 Difference of power of B-state frequency and Y-state frequency

The difference of the power of the B-state frequency and the Y-state frequency shall not exceed 2 dB.

4.2.2.2.5 Output spectrum

The output spectrum on DSC sending a dot pattern shall fall within the mask defined in figure 2.



fc: center frequency.

Figure 2: Output spectrum

4.2.2.3 Conformance

Conformance tests as described in clause 5.3.2 shall be carried out.

4.2.3 Power of out-of-band emissions of SSB telephony

4.2.3.1 Definition

Out-of band emissions are emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but excluding spurious emissions.

4.2.3.2 Limits

The power of any out-of-band emission supplied to the artificial antenna shall be in accordance with the limits given table 1.

Table 1: Limits for out-of-band emissions

Separation Δ in kHz between the frequency of the out-of-band emission and a frequency 1 400 Hz above the carrier	Minimum attenuation below maximum peak envelope power
$1,5 < \Delta \leq 4,5$	31 dB
$4,5 < \Delta \leq 7,5$	38 dB
$7,5 < \Delta \leq 12$	43 dB without exceeding the power of 50 mW

4.2.3.3 Conformance

Conformance tests as described in clause 5.3.3 shall be carried out.

4.2.4 Power of conducted spurious emissions of SSB telephony

4.2.4.1 Definition

Spurious emissions are emissions on a frequency or frequencies which are outside the necessary bandwidth, and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

4.2.4.2 Limits

The power of any conducted spurious emission at the antenna port shall be in accordance with table 2.

Table 2: Limits for conducted spurious emissions

Frequency range	Minimum attenuation below peak envelope power in Tx mode	Power in the Tx standby mode
9 kHz to 2 GHz	43 dB without exceeding the power of 50 mW	2 nW
> 2 GHz to 4 GHz	43 dB without exceeding the power of 50 mW	20 nW

4.2.4.3 Conformance

Conformance tests as described in clause 5.3.4 shall be carried out.

4.2.5 Carrier suppression

4.2.5.1 Definition

The carrier suppression is expressed in terms of the ratio between the peak envelope power and the carrier power output power.

4.2.5.2 Limits

The carrier suppression for modulation J3E shall be at least 40 dB.

4.2.5.3 Conformance

Conformance tests as described in clause 5.3.5 shall be carried out.

4.2.6 Maximum usable sensitivity

4.2.6.1 Definition

The maximum usable sensitivity is the minimum level of a radio frequency input signal with specified modulation which will produce at the receiver analogue outputs a chosen value of Signal plus Noise plus Distortion to Noise plus Distortion (SINAD) ratio and, at the same time an output power not less than the standard output power.

In the case of digital outputs it is the minimum level of a radio frequency input signal with specified modulation which will produce a chosen value of bit error ratio.

4.2.6.2 Limits

The maximum usable sensitivity shall be better than the values given in table 3.

Table 3: Limits of maximum usable sensitivity

Frequency range	Class of emission	Maximum level of input of input signal (dBµV) 50 Ω or 10 Ω and 250 pF source impedance	
		Normal conditions	Extreme conditions
1 605 kHz to 4 000 kHz			
	J3E	+16	+22
	F1B	+5	+11
4 MHz to 27,5 MHz			
	J3E	+11	+17
	F1B	+0	+6

4.2.6.3 Conformance

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

4.2.7 Adjacent signal selectivity

4.2.7.1 Definition

Adjacent signal selectivity is defined as the ability of the receiver to discriminate between a wanted signal (to which the receiver is tuned) and unwanted signals existing simultaneously in channels adjacent to that of the wanted signal or a increase of the bit error ratio to 10^{-2}.

4.2.7.2 Limits

The adjacent signal selectivity shall exceed the values given in the tables 4, 5 and 6.

Table 4: Class of emission J3E

Carrier frequency of unwanted signal relative to carrier frequency of wanted signal	Adjacent signal selectivity
-1 kHz and +4 kHz	40 dB
-2 kHz and +5 kHz	50 dB
-5 kHz and +8 kHz	60 dB

Table 5: Class of emission F1B

Carrier frequency of unwanted signal relative to carrier frequency of wanted signal	Adjacent signal selectivity
-500 Hz and +500 Hz	40 dB

Table 6: Class of emission F1B (Digital output)

Carrier frequency of unwanted signal relative to carrier frequency of wanted signal	Adjacent signal selectivity
-500 Hz and +500 Hz	BER = 10^{-2} or better

4.2.7.3 Conformance

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

4.2.8 Blocking or desensitization

4.2.8.1 Definition

Blocking is a change (generally a reduction) in the wanted output power of a receiver, or a reduction in the SINAD ratio, or an increase in the bit error rate due to an unwanted signal on another frequency.

4.2.8.2 Limits

Class of emission J3E or F1B (analogue output).

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

With the wanted signal at a level equal to the measured maximum usable sensitivity, the level of the unwanted signal shall be at least +65 dB above the measured usable sensitivity level.

Class of emission F1B (digital output)

The bit error ratio shall be 10^{-2} or better.

4.2.8.3 Conformance

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

4.2.9 Intermodulation response

4.2.9.1 Definition

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

4.2.9.2 Limits

The level of each of the two interfering signals which result in a 20 dB SINAD ratio at the receiver output shall be not less than +80 dBµV for J3E and +70 dBµV for analogue F1B.

The level of each of the two interfering signals which result in a bit error ratio of 10^{-2} for digital receivers shall be not less than +70 dBµV.

4.2.9.3 Conformance

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

4.2.10 Spurious response rejection ratio

4.2.10.1 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 SINAD ratio at the receiver output.

4.2.10.2 Limits

Class of emission J3E and Class of emission F1B (analogue output)

The spurious response rejection ratio shall not be less than 60 dB.

Class of emission F1B (Digital output)

The bit error ratio shall be 10^{-2} or better.

4.2.10.3 Conformance

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

4.2.11 Receiver spurious emissions

4.2.11.1 Definition

Spurious emissions are any radio frequency emissions generated in the receiver and radiated either by way of conduction to the antenna or other conductors connected to the receiver, or radiated directly by the receiver. For the purposes of the present document only spurious emissions conducted by way of the antenna shall be considered.

4.2.11.2 Limits

The power of any discrete component measured into 50 Ω shall not exceed 2 nW from 9 kHz to 2 GHz and 20 nW from 2 GHz to 4 GHz.

4.2.11.3 Conformance

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

5 Testing for compliance with technical requirements

5.1 Test conditions, power supply and ambient temperatures

5.1.1 General

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

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

5.1.2 Test power source

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

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

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

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

5.1.3 Normal test conditions

5.1.3.1 Normal temperature and humidity

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

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

5.1.3.2 Normal test power source

5.1.3.2.1 Mains voltage and frequency

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

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

5.1.3.2.2 Secondary battery power sources

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

5.1.3.2.3 Other power sources

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

5.1.4 Extreme test conditions

5.1.4.1 Extreme temperature tests

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

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

5.1.4.2 Extreme values of test power source

5.1.4.2.1 Mains voltage and mains frequency

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

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

5.1.4.2.2 Secondary battery power sources

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

5.1.4.2.3 Other power sources

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

5.1.5 Artificial antennas

5.1.5.1 Transmitters

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

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

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

5.1.5.2 Receivers

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

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

The arrangement used shall be stated in the test report.

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

5.1.6 Standard test signals

5.1.6.1 Test signals applied to the receiver input

5.1.6.1.1 Sources

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

5.1.6.1.2 Levels

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

5.1.6.2 Normal test signals

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

5.1.6.2.1 Class of emission J3E

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

5.1.6.2.2 Class of emission F1B

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

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

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

5.1.6.3 Choice of testing frequencies

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

The frequencies used shall be stated in the test report.

5.1.7 Warming up period

5.1.7.1 Time

The equipment shall be operational and shall meet the requirements of the present document one minute after switching on, except as provided in clause 5.1.7.2.

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 minutes 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 7.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 [7] 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 7 is based on such expansion factors.

Table 7: 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
Conducted spurious emissions of transmitter	±4 dB
Radiated spurious emissions	±6 dB
Audio output power	±0,5 dB
Sensitivity of receiver	±3 dB
Conducted emission of receiver	±3 dB
Two signal measurement	±4 dB
Three signal measurement	±3 dB

5.3 Essential radio test suites

5.3.1 Frequency error

The frequency shall be measured with the transmitter connected to an artificial antenna (see clause 5.1.5).

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

a) SSB telephony:

- the transmitter 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.

b) DSC with an analogue interface:

- the transmitter shall be modulated with a signal of 1 700 Hz ± 0,1 Hz.

c) DSC with a digital interface:

- the digital input shall first be connected to a digital 0 and then to a digital 1.

The results obtained shall be compared to the limits in clause 4.2.1.2 in order to prove compliance with the requirement.

5.3.2 Output power and intermodulation products

The transmitter shall be connected to the appropriate artificial antenna as specified in clause 5.1.5.1.

Operating frequencies shall be 2 182 kHz and each of the distress frequencies in bands 4 MHz, 6 MHz, 8 MHz, 12 MHz, 16 MHz and on one frequency in the highest band of operation as appropriate to the equipment.

a) For SSB telephony:

- 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. The level of the input test signal shall be increased until the transmitter power output is the rated output power as declared by the manufacturer ±1,5 dB. The level of the input signal shall then be increased by 10 dB;

- the peak envelope power and the intermodulation products shall be measured;

- the input signal shall then be decreased by 20 dB, and measurement of the intermodulation products is repeated;

- the test shall be repeated using the 600 Ω audio line input connections provided.

b) For DSC with an analogue interface:

- the transmitter shall be modulated by a generator producing a continuous dot pattern first at 0 dBm at 600 Ω and then at +10 dBm at 600 Ω. The mean power and the difference between the power of the Y-state frequency and the power of the B-state frequency shall be measured, and the output spectrum recorded.

c) For DSC with a digital interface:

- the transmitter shall be modulated by a generator producing a continuous dot pattern. The mean power and the difference between the power of the Y-state frequency and the power of the B-state frequency shall be measured, and the output spectrum recorded.

The tests shall be performed under both normal (clause 5.1.3) and extreme test conditions (clauses 5.1.4.1 and 5.1.4.2 applied simultaneously).

The results obtained shall be compared to the limits in clause 4.2.2.2 in order to prove compliance with the requirement.

5.3.3 Power of out-of-band emissions of SSB telephony

The transmitter shall be connected to the appropriate artificial antenna as specified in clause 5.1.5.1 and driven to the maximum output power measured in clause 5.3.2 by a modulating signal consisting of two audio-frequency tones with a frequency separation between them such that all intermodulation products occur at frequencies at least 1 500 Hz removed from a frequency 1 400 Hz above the carrier.

The test shall be carried out using the microphone input and the 600 Ω audio line input.

Any limiter or automatic control of the modulation level shall be in normal operation.

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to prove compliance with the requirement.

5.3.4 Power of conducted spurious emissions of SSB telephony

The transmitter shall be connected to a 50 Ω power attenuator. The modulation input shall be terminated by a 600 Ω termination, and the transmitter shall be placed in the transmit mode.

The spurious emissions shall be measured from 9 kHz to 4 GHz. The frequencies ±12 kHz of the assigned frequency shall be excluded from this transmitter test.

Any limiter or automatic control of the modulation level shall be in normal operation.

For stand-alone transmitters this test shall be repeated in the transmitter stand-by mode. The frequencies within the centre frequency fc and fc + 2,7 kHz shall be excluded from this transmitter test.

The results obtained shall be compared to the limits in clause 4.2.4.2 in order to prove compliance with the requirement.

5.3.5 Carrier suppression

The transmitter shall be connected to the appropriate artificial antenna described in clause 5.1.5.1. It shall then be modulated by an audio frequency of 1 000 Hz to produce the maximum output power as measured in clause 5.3.2.

The carrier suppression shall be measured in J3E mode.

The test shall be performed under both 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 4.2.5.2 in order to prove compliance with the requirement.

5.4 Other test specifications

5.4.1 General

The requirements in clauses 4.2.6 to 4.2.11 inclusive have been set on the assumption that the test specifications in clauses 5.4.2 to 5.4.7 will be used to verify the performance of the equipment.

5.4.2 Maximum usable sensitivity

With the AGC operative, tests shall be carried out with the receiver adjusted for each frequency range and class of emission for which it is designed. The test input signal to the receiver shall be the normal test signals specified in clause 5.1.6.2.

For each test the input level of the test signal shall be adjusted until the SINAD ratio at the receiver output is 20 dB or the bit error ratio is less than 10^{-2} and at the same time at least the standard output power or levels are obtained. The measured input level is the maximum usable sensitivity. Where a bit error ratio test is carried out the tests shall be repeated with the input signal ±10 Hz of its nominal value.

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 4.2.6.2 in order to prove compliance with the requirement.

5.4.3 Adjacent signal selectivity

The arrangements for applying two test signals to the receiver input, shall be according to clause 5.1.6.1. The AGC shall be in operation.

The wanted signal shall be in accordance with clause 5.1.6.2.

Class of emission J3E and Class of emission F1B (analogue output)

Analogue receivers shall be adjusted to give standard output power on the wanted frequency, and to give a SINAD ratio, of 20 dB.

The level of the unwanted signal shall be increased (starting from a low level), until the SINAD ratio, is decreased from 20 dB to 14 dB or the bit error ratio decreases to 10^{-2}.

Class of emission F1B (Digital output)

NOTE: Measurement on F1B is only required if the receiver does not have the J3E mode.

The wanted signal level shall be 20 dBµV, and shall be modulated with the sequence from the BER generator. The unwanted signal shall have a level of +60 dBµV and be unmodulated.

Digital receivers shall have a bit error ratio of better than 10^{-2}.

The wanted signal level shall be +20 dBµV.

The results obtained shall be compared to the limits in clause 4.2.7.2 in order to prove compliance with the requirement.

5.4.4 Blocking or desensitization

The tests shall be carried out in J3E with the AGC operative, the RF/IF gain control (if provided) at its maximum, and any input attenuator adjusted to minimum attenuation. The measurements 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.

Class of emission J3E or F1B (analogue output)

Measurements shall be carried out with an input level of the wanted signal of +60 dBµV and repeated with the wanted signal at a level equal to the maximum usable sensitivity of the receiver as measured in clause 5.4.2.

The wanted test input signal to the receiver shall be the normal test signal specified in clause 5.1.6.2.

The receiver shall be adjusted so that the wanted signal gives standard output power.

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

The unwanted signal shall be unmodulated. 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 of the SINAD ratio of 6 dB, whichever effect occurs first. The input level of the unwanted signal, when the specified condition is reached, shall be taken as the blocking level.

Class of emission F1B (digital output)

NOTE: Measurement on F1B is only required if the receiver does not have the J3E mode.

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

The unwanted signal shall be unmodulated. The input level of the unwanted signal shall be set to a level of +100 dBµV.

The results obtained shall be compared to the limits in clause 4.2.8.2 in order to prove compliance with the requirement.

5.4.5 Intermodulation response

5.4.5.1 Class of emission J3E

With the AGC operative, the RF/IF gain control (if provided) at its maximum, and any input attenuator adjusted to minimum attenuation, an unmodulated input signal 1 000 Hz higher than the frequency to which the receiver is tuned 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.

With the wanted signal still applied, two equal level unmodulated signals shall be simultaneously applied to the input of the receiver, neither of these two signals shall have a frequency within 30 kHz from the wanted signal.

When choosing the frequencies used for this measurement, care should be taken to avoid frequencies at which spurious responses occur.

NOTE: Input frequencies likely to cause unwanted intermodulation products are described in ITU-R Recommendation SM.332-4, section 6.4 (see bibliography).

The input levels of the two interfering signals shall remain equal and shall be adjusted to reduce the SINAD ratio at the receiver output to 20 dB, carefully adjusting the frequency of one of the unwanted signals to maximize the reduction in SINAD ratio.

5.4.5.2 Class of emission F1B analogue

With the AGC operative, the RF/IF gain control (if provided) at its maximum, and any input attenuator adjusted to minimum attenuation, an unmodulated input signal on the assigned frequency shall be applied to the receiver input at a level of +20 dBµV.

With the wanted signal still applied, two equal level unmodulated signals shall be simultaneously applied to the input of the receiver, neither of these two signals shall have a frequency within 30 kHz from the wanted signal.

When choosing the frequencies used for this measurement, care should be taken to avoid frequencies at which spurious responses occur.

NOTE: Input frequencies likely to cause unwanted intermodulation products are described in ITU-R Recommendation SM.332-4, section 6.4 (see bibliography).

The input levels of the two interfering signals shall remain equal and shall be adjusted to reduce the SINAD ratio at the receiver output to 20 dB, carefully adjusting the frequency of one of the unwanted signals to maximize the reduction in SINAD ratio.

5.4.5.3 Class of Emission F1B digital

With the AGC operative, the RF/IF gain control (if provided) at its maximum, and any input attenuator adjusted to minimum attenuation, a signal on the assigned frequency shall be applied to the receiver input at a level of +20 dBµV, modulated with a signal of 100 baud with a frequency shift of ±85 Hz suitable for bit error ratio tests.

Two equal level unmodulated signals shall be simultaneously applied to the input of the receiver, neither of these two signals shall have a frequency within 30 kHz from the wanted signal.

When choosing the frequencies used for this measurement, care should be taken to avoid frequencies at which spurious responses occur.

NOTE: Input frequencies likely to cause unwanted intermodulation products are mentioned in ITU-R Recommendation SM.332-4, section 6.4 (see bibliography).

The input levels of the two interfering signals shall remain equal and shall be adjusted to reduce the bit error ratio at the receiver output to 10^{-2}, carefully adjusting the frequency of one of the unwanted signals to maximize the reduction in bit error ratio.

5.4.5.5 Results

The results obtained shall be compared to the limits in clause 4.2.9.2 in order to prove compliance with the requirement.

5.4.6 Spurious response rejection ratio

Frequencies likely to cause a spurious response are at the image frequencies of the mixers and at the various IF frequencies used in the receiver.

Manufactures should provide the test house with a simple block diagram showing:

- the IF frequencies used;
- the local oscillater frequencies used;
- the coverage range;
- the pre first mixer filtering arrangements.

Test should be made with a wanted frequency on 2 182 kHz for J3E receivers and 2 187,5 kHz for F1B receivers if the coverage is between 1 605 kHz and 4 000 kHz and 8 291 kHz for J3E receivers and 8 376,5 kHz for F1B receivers if the coverage is between 1 605 kHz and 27,5 MHz.

NOTE: Measurements on F1B are only required if the receiver does not have the J3E mode.

The following tests shall be made:

- a complete search of the coverage range;
- a measurement of all IF frequencies outside that range;
- a measurement of all frequencies defined by:

  $n * f_{lo1} \pm f_{if1}$;

  $p * f_{receive} \pm f_{if1}$;

  $(f_{lo2} \pm f_{if2}) \pm f_{lo1}$;

  where n and p are integers and f_{lo1} is the local oscillator frequency of the first mixer, f_{if1} is the first IF frequency and f_{lo2} is the local oscillator frequency of the second mixer, f_{if2} is the second IF frequency.

If the measurements are within 10 dB of the limit, the integers n & p need not exceed 10, otherwise the upper frequency of the test shall be 2 GHz.

Care should be taken when measuring IF rejection within the coverage range.

If the wanted signal frequency causes a filter to be introduced that improves the IF response, then another wanted frequency should be chosen in the same band as the IF frequency without being closer than 100 kHz of the IF frequency.

Where measurements are made close to the wanted signal, the levels and tests provided for these conditions in the present document shall take precedence. No testing is necessary closer than 20 kHz to the wanted signal.

The receiver shall be set up in accordance with clause 5.4.3. All receiver controls shall remain unaltered during the remainder of the test.

Two signal generators A and B shall be connected to the receiver input via a combining network so that they do not affect the impedance matching.

Class of emission J3E and Class of emission F1B (analogue output)

The wanted signal represented by signal generator A shall be at the nominal frequency and shall have test modulation according to clause 5.1.6.2, the level shall be at the sensitivity level required in table 3.

Signal generator B shall have a level of at least 80 dB above the level of signal generator A, and the frequencies shall be according to the above mentioned.

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 until a SINAD ratio of 14 dB at the output of the receiver is achieved.

The ratio between the input level of each spurious signal and the input of the wanted signal giving the same SINAD ratio, shall then be evaluated.

Class of emission F1B (Digital output)

The level of signal generator A shall be 3 dB above the sensitivity level required in table 4.

Signal generator B shall be at the level 70 dB above the level of signal generator A, and the frequencies shall be according to the above mentioned.

The results obtained shall be compared to the limits in clause 4.2.10.2 in order to prove compliance with the requirement.

5.4.7 Receiver spurious emissions

The receiver antenna port shall be terminated into 50 Ω and a search shall be made for the presence of signals appearing across the resistor. The measurement shall be made over the frequency range 9 kHz to 4 GHz.

The results obtained shall be compared to the limits in clause 4.2.11.2 in order to prove compliance with the requirement.

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

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

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

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

EN Reference		EN 300 373-2				Comment
No.	**Reference**	**EN-R (note)**	**Status**			
1	4.2.1	Frequency error	M			
2	4.2.2	Output power and intermodulation products	M			
3	4.2.3	Power of out-of-band emissions of SSB telephony	M			
4	4.2.4	Power of conducted spurious emissions of SSB telephony	M			
5	4.2.5	Carrier suppression	M			
6	4.2.6	Maximum usable sensitivity	M			
7	4.2.7	Adjacent signal selectivity	M			
8	4.2.8	Blocking or desensitization	M			
9	4.2.9	Intermodulation response	M			
10	4.2.10	Spurious response rejection ratio	M			
11	4.2.11	Receiver spurious emissions	M			
NOTE: These EN-Rs are justified under article 3.2 of the R&TTE Directive.						

Key to columns:

No Table entry number;

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

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

Status Status of the entry as follows:

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

Comments To be completed as required.

Annex B (informative): Bibliography

- ITU-R Recommendation SM.332-4: "Selectivity of receivers".
- ITU-R Recommendation SM.326-6: "Determination and measurement of the power of amplitude-modulated radio transmitters".
- ETSI EN 300 373-1: "Radio Equipment and Systems (RES); Technical characteristics and methods of measurement for maritime mobile transmitters and receivers for use in the MF and HF bands".

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

Language	EN title
Danish	Elektromagnetisk kompatibilitet og Radiospektrum Anliggender (ERM); Maritime mobile sendere og modtagere til brug i MF og HF båndene; Del 2: Harmoniseret EN, som dækker de væsentlige krav i R&TTE direktivets artikel 3.2
Dutch	Elektromagnetische compatibiliteit en radiospectrumzaken (ERM); Zendapparatuur voor amplitude gemoduleerde (AM) radio-omroepdiensten; Deel 2: Geharmoniseerde Europese Norm die invulling geeft aan de wezenlijke vereisten, neergelegd in artikel 3.2 van de R&TTE Richtlijn
English	Electromagnetic compatibility and Radio spectrum Matters (ERM); Maritime mobile transmitters and receivers for use in the MF and HF bands; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive
Finnish	Sähkömagneettinen yhteensopivuus ja radiospektriasiat (ERM); Siirtyvän meriradioliikenteen MF ja HF -taajuusalueiden lähettimet ja vastaanottimet; Osa 2: R&TTE-direktiivin artiklan 3.2 mukaiset olennaiset vaatimukset määrittelevä harmonisoitu standardi (EN)
French	Compatibilité électromagnétique et Spectre radioélectrique (ERM); Emetteurs et récepteurs mobiles maritimes fonctionnant dans les bandes d'ondes hectométriques et décamétriques; Partie 2: EN harmonisée couvrant les exigences essentielles de l'article 3.2 de la Directive R&TTE
German	Elektromagnetische Vertraglichkeit und Funkspektrumsangelegenheiten (ERM); Seefunkeinrichtungen, mobile Sender und Emfanger fur den Mittel- und Kurzwellenbereich; Teil 2: Harmonisierte Europaische Norm (EN) mit wesentlichen Anforderungen nach R&TTE Richtlinie Artikel 3.2
Greek	Ηλεκτρο μαγνητική συ μβατότητα και θέ ματα ραδιοφά σματος (ERM); Φορητοί πομποί για ναυτηλία και δέκτες για χρήση στις ζώνες MF και HF; Μέρος 2^{o}: Εναρμονισμένη EN που καλύπτει τις βασικές προυποθέσεις σύμφωνα με το άρθρο 3.2 της οδηγίας R&TTE.
Italian	Compatibilità elettromagnetica e Questioni relative allo spettro delle radiofrequenze (ERM); Trasmettitori e ricevitori marittimi mobili per uso nelle gamme di frequenza MF e HF; Parte 2: EN armonizzata relativa ai requisiti essenziali dell'articolo 3, paragrafo 2, della direttiva R&TTE
Portuguese	Assuntos de Espectro Radioeléctrico e Compatibilidade Electromagnética (ERM); Transmissores e Receptores para o Serviço Móvel Marítimo operando nas faixas de MF e HF; Parte 2: EN Harmonizada cobrindo os requisitos essenciais no âmbito do artigo 3º, nº 2 da directiva R&TTE
Spanish	Compatibilidad electromagnética y cuestiones de espectro de radiofrecuencia (ERM); Radioteléfonos transmisores y receptores para el servicio móvil marítimo operando en las bandas de MF y HF; Parte 2: EN armonizada cubriendo los requisitos esenciales según el artículo 3.2 de la Directiva 1999/5/CE (R&TTE)
Swedish	Elektromagnetisk kompatibilitet och radiospektrumfrågor (ERM); Maritima mobila sändare och mottagare för användning i MF- och HF-banden; Del 2: Harmoniserad EN omfattande väsentliga krav enligt artikel 3.2 i R&TTE-direktivet

History

Document history			
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