INTERNATIONAL STANDARD

IEC 1097-12

First edition
1996-11

Global maritime distress and safety system (GMDSS) –

Part 12:
Survival craft portable two-way VHF radiotelephone apparatus – Operational and performance requirements, methods of testing and required test results

Système mondial de détresse et de sécurité en mer (SMDSM) –

Partie 12:
Radiotéléphone émetteur-récepteur portable VHF pour embarcation de sauvetage – Exigences d'exploitation et de fonctionnement, méthodes d'essai et résultats d'essai exigés

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– IEC 27: *Letter symbols to be used in electrical technology;*

– IEC 417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets;*

– IEC 617: *Graphical symbols for diagrams;*

and for medical electrical equipment,

– IEC 878: *Graphical symbols for electromedical equipment in medical practice.*

The symbols and signs contained in the present publication have either been taken from IEC 27, IEC 417, IEC 617 and/or IEC 878, or have been specifically approved for the purpose of this publication.

IEC publications prepared by the same technical committee

The attention of readers is drawn to the end pages of this publication which list the IEC publications issued by the technical committee which has prepared the present publication.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 12: Survival craft portable two-way VHF radiotelephone apparatus – Operational and performance requirements, methods of testing and required test results

FOREWORD

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International Standard IEC 1097-12 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

The text of this standard is based on the following documents:

FDIS	Report on voting
80/126/FDIS	80/136/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annexes A and B form an integral part of this standard.

Annex C is for information only.

The French version of this standard will be issued separately.

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) – Part 12: Survival craft portable two-way VHF radiotelephone apparatus – Operational and performance requirements, methods of testing and required test results

1 Scope

This part of IEC 1097 specifies the minimum performance requirements, technical characteristics and methods of testing with required test results of survival craft portable two-way radiotelephone apparatus as required by chapter III of the 1988 amendments to the 1974 International Convention for the Safety of Life at Sea (SOLAS), and which is associated with IEC 945. When a requirement in this standard is different from IEC 945, the requirement in this standard shall take precedence.

This standard incorporates the applicable parts of the performance requirements included in IMO Resolution A.809(19) annex 1 and the technical characteristics included in ITU M.489-2 and ITU-R M.542-1, and takes account of the general requirements contained in IMO Resolution A.694(17), and conforms with the ITU Radio Regulations where applicable.

NOTE – All text of this standard, whose wording is identical to that in IMO Resolutions A.809(19) and A.694(17) and ITU-R M.489-2 is printed in *italics* and the Resolution/Recommendation and paragraph numbers are indicated in brackets.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 1097. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 1097 are encouraged to investigate the possibility of applying the most recent edition of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 529: 1989, *Degrees of protection provided by enclosures (IP code)*

IEC 945: 1994, *Marine navigational equipment – General requirements – Methods of testing and required test results*

IMO International Convention for the Safety of Life At Sea (SOLAS): 1974, as amended 1988 (GMDSS) – *Chapter III: Life-saving appliances and arrangements*

IMO Resolution A.694(17): 1991, *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO Resolution A.809(19): 1995, *Performance standards for survival craft two-way VHF radiotelephone apparatus*

ITU Radio Regulations: 1995, *Appendix S3: Table of maximum permitted spurious emissions power levels*

ITU Radio Regulations: 1990, *Appendix 18: Table of transmitting frequencies in the band 156 – 174 MHz for stations in the maritime mobile service*

ITU-R M.489-2: 1995, *Technical characteristics of radiotelephone equipment operating in the maritime mobile service in channels spaced by 25 kHz*

ITU-R M.542-1: 1982, *On-board communications by means of portable radiotelephone equipment*

3 Performance requirements

3.1 *Introduction*

Performance requirements described in this clause are specified by referring to IMO Resolutions and ITU Recommendations. In addition to meeting performance requirements in this clause, the equipment shall comply with the technical characteristics contained in clause 4 of this standard.

3.2 *General*

3.2.1 (A.809(19) 1/2.1) *The equipment* shall *be portable and capable of being used for on-scene communication between survival craft, between survival craft and ship and between survival craft and rescue unit. It may also be used for on-board communications when capable of operating on appropriate frequencies.*

3.2.2 (A.809(19) 1/2.3) *The equipment* shall*:*

1) be capable of being operated by unskilled personnel;

2) be capable of being operated by personnel wearing gloves as specified for immersion suits in regulation 33 of chapter III of the SOLAS 1974 Convention;

3) be capable of single-handed operation except for channel selection;

9) be of small size and light weight;

10) be capable of operating in the ambient noise level likely to be encountered on board ships or survival craft;

11) have provisions for its attachment to the clothing of the user, including the immersion suit; and

12) be resistant to deterioration by prolonged exposure to sunlight.

3.2.3 (A.809(19) 1/2.3.13) *The equipment* shall *be either of a highly visible yellow/orange colour or marked with a surrounding yellow/orange marking strip.*

3.3 *General requirements*

3.3.1 *Composition*

(A.809(19) 1/2.2) *The equipment* shall *comprise at least:*

1) *an integral transmitter/receiver including antenna and battery;*

2*) an integral control unit including a press-to-transmit switch;*

3) *an internal microphone and loudspeaker.*

3.3.2 *Controls and indicators*

3.3.2.1 (A.809(19) 1/4.1) *An on/off switch* shall *be provided with positive visual indication that the radiotelephone is switched on.*

3.3.2.2 (A.809(19) 1/4.2) *The receiver* shall *be provided with a manual volume control by which the audio output may be varied.*

3.3.2.3 (A.809(19) 1/4.3) *A squelch (mute) control and channel selection switch* shall *be provided.*

3.3.2.4 (A.809(19) 1/4.4) *Channel selection* shall *be easily performed and the channels shall be clearly discernible.*

3.3.2.5 (A.809(19) 1/4.5) *Channel indication* shall *be in accordance with appendix 18 of the Radio Regulations*.

3.3.2.6 (A.809(19) 1/4.6) *It* shall *be possible to determine that channel 16 has been selected in all ambient light conditions.*

3.3.3 *Antenna*

(A.809(19) 1/9) *The antenna* shall *be vertically polarized and, as far as practicable, be omnidirectional in the horizontal plane. The antenna* shall *be suitable for efficient radiation and reception of signals at the operating frequency.*

3.3.4 *Safety precautions*

3.3.4.1 (A.809(19) 1/6) *The equipment* shall *not be damaged by the effect of open-circuiting or short-circuiting the antenna.*

3.3.4.2 (A.809(19) 1/2.3.8) *The equipment* shall *have no sharp projections which could damage survival craft.*

3.3.5 *Frequency bands and channels*

3.3.5.1 (A.809(19) 1/3.1) *The two-way radiotelephone* shall *be capable of operation on the frequency 156,800 MHz (VHF CH 16) and on at least one additional channel.*

3.3.5.2 (A.809(19) 1/3.2) *All channels fitted* shall *be for single-frequency voice communication only.*

3.3.5.3 (A.809(19) 1/3.3) *The class of emission* shall be G3E to *comply with appendix 19 of the Radio Regulations.*

3.3.6 *Marking and identification*

(A.809(19) 1/13) *In addition to the items specified in resolution A.694(17) on general requirements,* as detailed in IEC 945, *the following* shall *be clearly indicated on the exterior of the equipment:*

1) *brief operating instructions;*
2) *expiry date for the primary batteries*.

3.3.7 *Warming-up period*

(A.809(19) 1/5) *The equipment* shall *be operational within 5 s of switching on.*

3.3.8 *Power supply*

3.3.8.1 (A.809(19) 1/12.1) *The source of energy* shall *be integrated in the equipment and may be replaceable by the user. In addition, provision may be made to operate the equipment using an external source of electrical energy.*

3.3.8.2 (A.809(19) 1/12.2) *Equipment intended for the source of energy to be user replaceable* shall *be provided with a dedicated primary battery for use in the event of a distress situation. This battery* shall *be equipped with a non-replaceable seal to indicate that it has not been used.*

3.3.8.3 (A.809(19) 1/12.3) *Equipment intended for the source of energy to be non-user-replaceable* shall *be provided with a primary battery. The portable two-way radiotelephone equipment* shall *be equipped with a non-replaceable seal to indicate that it has not been used.*

3.3.8.4 (A.809(19) 1/12.4) *The primary battery* shall *have sufficient capacity to ensure 8 h operation at its highest rated power with a duty cycle of 1: 9. The duty cycle is defined as 6 s transmission, 6 s reception above squelch opening level and 48 s reception below squelch opening level.*

3.3.8.5 (A.809(19) 1/12.5) *Primary batteries* shall *have a shelf life of at least 2 years and if intended to be user replaceable* shall *be of a colour or marking as defined in* 3.2.3.

3.3.8.6 (A.809(19) 1/12.6) Primary or secondary *batteries not intended for the use in the event of a distress situation* shall *be of a colour or marking so that they cannot be confused with batteries intended for such use.*

3.4 *Environmental requirements*

3.4.1 (A.809(19) 1/11) *The equipment* shall *be so designed as to operate over the temperature range –20 °C to +55 °C. It* shall *not be damaged in stowage throughout the temperature range –30 °C to + 70 °C.*

3.4.2 (A.809(19) 1/2.3.4) *The equipment* shall *withstand drops on to a hard surface from a height of 1 m.*

3.4.3 (A.809(19) 1/2.3.5) *The equipment* shall *be watertight to a depth of 1 m for at least 5 min.*

3.4.4 (A.809(19) 1/2.3.6) *The equipment* shall *maintain watertightness when subjected to a thermal shock of 45 °C under conditions of immersion.*

3.4.5 (A.809(19) 1/2.3.7) *The equipment* shall *not be unduly affected by seawater or oil or both.*

3.5 *Electromagnetic compatibility*

The equipment shall comply with the EMC requirements specified in resolution A.694(17), as detailed in IEC 945.

4 Technical characteristics

4.1 *General*

The equipment shall be designed to operate satisfactorily with a channel separation of 25 kHz in accordance with appendix 18 of the Radio Regulations.

4.2 *Class of emission and modulation characteristics*

4.2.1 (M.489-2/1.1.1 and .3) *The class of emission* shall *be G3E (frequency modulation with a pre-emphasis characteristic of 6 dB/Octave).*

4.2.2 (M.489-2/1.1.2) *The necessary bandwidth* shall *be 16 kHz.*

4.3 *Transmitter*

4.3.1 (M.489-2/1.2.1) *The frequency tolerance for ship station transmitters* shall *not exceed 10 parts in* 10^6. For practical reasons, the frequency error shall be within ±1,5 kHz.

4.3.2 (A.809(19) 1/7) *The effective radiated power* shall *be a minimum of 0,25 W. Where the effective radiated power exceeds 1 W, a power reduction switch to reduce the power to 1 W or less is required. When this equipment provides for on-board communications, the output power* shall *not exceed 1 W on these frequencies.*

4.3.3 The frequency deviation corresponding to 100% modulation shall approach ±5 kHz as nearly as practicable.

4.3.4 (M.489-2/1.2.5) *The upper limit of the audiofrequency band* shall *not exceed 3 kHz.*

4.3.5 (M.489-2/1.2.2) *Spurious emissions on discrete frequencies, when measured in a non-reactive load equal to the nominal output impedance of the transmitter* shall *be in accordance with the provisions of Appendix 8 of the Radio Regulations.* The power of any conducted spurious emission on any discrete frequency shall not exceed 0,25 μW.

4.3.6 (M.489-2/1.2.6) *The cabinet radiated power* shall *not exceed 25 μW. In some radio environments, lower values may be required*. The equipment shall meet the requirements of IEC 945 for radiated interference.

4.4 *Receiver*

4.4.1 (A.809(19) 1/8.1) *The sensitivity of the receiver* shall *be equal to or better than 2 μV e.m.f. for a SINAD ratio of 12 dB at the output.*

4.4.2 (A.809(19) 1/8.2) *The immunity to interference of the receiver* shall *be such that the wanted signal is not seriously affected by unwanted signals.*

4.4.3 (A.809(19)1/10.1) *The audio output* shall *be sufficient to be heard in the ambient noise level likely to be encountered on board ships or in a survival craft.*

4.4.4 (A.809(19) 1/10.2) *In the transmit condition the output of the receiver* shall *be muted.*

4.4.5 (M.489-2/1.3.2) *The adjacent channel selectivity* shall *be at least 70 dB.*

4.4.6 (M.489-2/1.3.3) *The spurious response rejection ratio* shall *be at least 70 dB*.

4.4.7 (M.489-2/1.3.4) *The radio frequency intermodulation response ratio* shall *be at least 65 dB.*

4.4.8 (M.489-2/1.3.5) *The power of any conducted spurious emission measured at the antenna terminals* shall *not exceed 2,0 nW at any discrete frequency.*

5 Methods of testing and required test results

Environmental tests shall be carried out before tests to verify whether the equipment under test (EUT) meets all technical requirements. Where electrical tests are required, these shall be done using the normal test voltage as specified in IEC 945 unless otherwise stated.

In each test item indicated below, the related requirement can be identified by referring to the text with subclause number in brackets.

5.1 *Test conditions*

For field measurements and performance checks to this standard, the EUT shall be operational on channel 17.

5.1.1 *Normal and extreme test conditions*

Tests shall be made under normal test conditions and also, where stated, under extreme test conditions as specified in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously.

5.1.2 *Test power source*

During each test the EUT shall be supplied from a test power source, capable of producing normal and extreme test voltages. For the purpose of tests, the voltage of the power source shall be measured at the input terminals of the EUT. During tests, the power supply voltages shall be maintained within ±3 % relative to the voltage level at the beginning of each test.

The test power source shall only be used in measurements where the use of the test power source is mutually agreed between manufacturer and test house. In the event of any discrepancy, results obtained using the batteries shall take precedence over results obtained using the test power source.

5.1.3 *Procedure for tests at extreme temperatures*

For tests at low temperature, the EUT shall be placed in the test chamber and left until thermal equilibrium is reached and shall then be switched to stand-by or receive position for 5 s after which the EUT shall meet the requirements of this standard.

5.1.4 *Performance check*

5.1.4.1 *Definition*

The performance check means a shortened form of the test required by the relevant standard under normal test conditions, such as could normally be carried out in no more than 15 min.

5.1.4.2 *Method of measurement*

After each environmental test a performance check shall be made, which shall include the following:

– the transmitter frequency error to 5.4.1.2 and the output power of the transmitter to 5.4.3.2 (high power only); and

– the receiver maximum usable sensitivity to 5.5.3.2.

5.1.4.3 *Results required*

The frequency error shall be less than ±1,5 kHz, the carrier power shall be not less than 0,25 W and the receiver sensitivity shall be better than 12 dBμV.

5.1.5 *Environmental tests*

Environmental tests are intended to assess the suitability of the construction of the EUT for its intended physical conditions of use. After environmental tests, and, if specified also during the test, the EUT shall comply with the requirements of a performance check.

Environmental tests shall be carried out before any other tests. Where electrical tests are required, these shall be done with the normal test voltage unless otherwise stated.

Environmental tests shall be carried out in the following order.

5.1.5.1 *Drop test*

This test simulates the effects of a free fall of the EUT onto the deck of a ship resulting from mishandling.

The drop test shall be performed as specified in IEC 945.

During the test the equipment shall be fitted with a suitable set of batteries and its antenna, but it shall be switched off.

At the end of the test the EUT shall be subjected to a performance check and shall then be examined for damage. The findings shall be noted in the test report.

5.1.5.2 *Thermal shock*

This test determines the ability of the EUT to function correctly after sudden immersion in water from storage at high temperature.

The EUT shall be placed in an atmosphere of +65 °C ± 3 °C for 1 h. It shall then be immersed in water at +20 °C ± 3 °C to a depth of 100 mm ± 5 mm, measured from the highest point of the equipment to the surface of the water, for a period of 1 h.

At the end of the test the EUT shall be subjected to a performance check and shall then be examined for damage and for unwanted ingress of water. The findings shall be noted in the test report.

Following the examination, the EUT shall be resealed in accordance with manufacturer´s instructions. Alternatively, if there are no external signs of unwanted ingress of water, an internal examination of the EUT which involves disturbance to seals may be carried out after all environmental tests have been completed.

5.1.5.3 *Immersion test*

This test simulates the effects of water pressure on the EUT which although not designed to float may experience a temporary immersion in water.

The EUT shall be subjected to the test corresponding to IEC 529, table III, second characteristic numeral 7. The test shall be carried out by completely immersing the EUT in water so that the following conditions are satisfied:

– the highest point of the EUT is located 1 m below the surface of the water;
– the duration of the test is 5 min; and
– the water temperature does not differ from that of the equipment by more than 5 °C.

At the end of the test the EUT shall be subjected to a performance check and shall then be examined for damage and for unwanted ingress of water. The findings shall be noted in the test report.

Following the examination, the EUT shall be resealed in accordance with manufacturer´s instructions. Alternatively, if there are no external signs of unwanted ingress of water, an internal examination of the EUT which involves disturbance to seals may be carried out after all environmental tests have been completed.

5.1.5.4 *Dry heat cycle*

The dry heat cycle test shall be performed as specified in IEC 945.

5.1.5.5 *Damp heat cycle*

The damp heat cycle test shall be performed as specified in IEC 945.

5.1.5.6 *Low temperature cycle*

The low temperature cycle test shall be performed as specified in IEC 945.

5.1.5.7 *Vibration*

The vibration test shall be performed as specified in IEC 945.

5.1.5.8 *Oil resistance test*

The EUT shall be immersed at a temperature of +19 °C ± 1 °C for 3 h in mineral oil of the following specification:

Aniline point: 120 °C ± 5 °C
Flash point: minimum 240 °C
Viscosity: 10-25 cSt at 99 °C.

The following oil may be used:

– ASTM oil number 1;
– ASTM oil number 5, or
– ISO oil number 1.

At the end of the test the EUT shall be cleaned and examined for deterioration of the external structure. The findings shall be noted in the test report.

5.1.5.9 *Solar radiation test*

The EUT shall be placed in the test enclosure on a suitable support and exposed continuously to a simulated solar radiation source as specified in annex B, for 80 h.

At the end of the test the EUT shall be cleaned and examined for deterioration of the external structure. The findings shall be noted in the test report.

5.1.5.10 *Mould growth and corrosion test*

The manufacturer shall produce evidence that the components, materials and finishes employed in the equipment satisfy the mould growth and corrosion tests.

5.1.6 *Unspecified test conditions*

Any requirement in clauses 3 and 4 for which no test is specified in this clause 5 shall be checked by inspection of the equipment, the manufacturing drawings or other relevant documents. The result of the inspection shall be stated in the test report.

5.2 *General conditions of measurement*

5.2.1 *Arrangements for test signals applied to the receiver input*

The source of test signals for application to the receiver input shall be connected in such a way that the impedance presented to the receiver input is 50 Ω, irrespective of whether one or more signals are applied to the receiver simultaneously. The level of the test signals shall be expressed in terms of the electromotive force (e.m.f) at the terminals to be connected to the receiver. The nominal frequency of the receiver is the carrier frequency of the selected channel.

5.2.2 *Receiver squelch facility*

Unless otherwise specified, the squelch circuit shall be set inoperative for the duration of the test.

5.2.3 *Normal test modulation*

For normal test modulation, the modulating frequency shall be 1 kHz and the frequency deviation shall be ±3 kHz. The test signal shall be substantially free from amplitude modulation.

5.2.4 *Artificial antenna*

When tests are carried out with an artificial antenna, this shall be a non-reactive, non-radiating 50 Ω load. For these tests the equipment integral antenna shall be substituted by suitable means for connecting the artificial antenna.

5.2.5 *Arrangements for test signals applied to the transmitter input*

For the purpose of this standard, the transmitter audiofrequency modulation signal shall be supplied by a generator to an interface connected to the microphone input and this interface shall be provided by the manufacturer.

5.2.6 *Test channels*

Unless otherwise stated, tests to this standard shall be made on channel 16 (156,8 MHz).

Field measurements and performance checks shall be made on channel 17.

5.2.7 *Measurement uncertainty*

Maximum values of absolute measurement uncertainties shall be as follows:

RF frequency	$\pm 1 \times 10^{-7}$
RF power	±0,75 dB
Maximum frequency deviation:	
– within 300 Hz to 6 kHz of audiofrequency	±5 %
– within 6 kHz to 25 kHz of audiofrequency	±3 dB
Deviation limitation	±5 %
Adjacent channel power	±5 dB
Conducted spurious of transmitter	±4 dB
Audio output power	±0,5 dB
Amplitude characteristic of receiver limiter	±1,5 dB
Sensitivity at 20 dB SINAD	±3 dB
Conducted emission of receiver	±3 dB
Two-signal measurement	±4 dB
Three-signal measurement	±3 dB
Radiated emission of transmitter	±6 dB
Radiated emission of receiver	±6 dB
Receiver desensitization at duplex operation	±0,5 dB
Transmitter transient time	±20 %
Transmitter transient frequency	±250 Hz

5.3 (3.3.8) *Power supply*

5.3.1 *Definition*

For the purpose of the conformance test the power supply shall be deemed to be the integrated source of energy for the EUT which shall be a primary battery.

5.3.2 *Method of measurement*

5.3.2.1 (3.3.8.4) *Capacity*

The equipment with an unused primary battery shall be tested in accordance with the duty cycle specified in 3.3.8.4 to verify compliance with the capacity requirements of 3.3.8.4 under extreme low temperature conditions.

5.3.2.2 (3.3.8.5) *Expiry date*

The manufacturer shall declare the expiry date of the battery which shall be at least 2 years under stowage temperature conditions.

5.3.2.3 (3.3.8.5, 3.3.8.6) *Colour*

By inspection.

5.3.3 *Required results*

a) Capacity

The capacity requirements of 3.3.8.4 shall be met.

b) Expiry date

The EUT or primary battery as applicable shall bear a label indicating the expiry date of the battery, which shall be no more than the declared shelf life.

c) Colour

The primary battery for use in the event of a distress situation shall have a colour or marking as defined in 3.2.3. Other batteries shall have a colour or marking so that they cannot be confused with the primary battery.

5.4 *Transmitter*

The performance requirements and technical characteristics of this standard shall be verified according to the test procedures described below.

5.4.1 (4.3.1) *Frequency error*

5.4.1.1 *Definition*

The frequency error is the difference between the measured carrier frequency and the assigned frequency.

5.4.1.2 *Method of measurement*

The carrier frequency shall be measured in the absence of modulation with the transmitter connected to an artificial antenna. The measurement shall be carried out under normal test conditions and extreme test conditions as defined in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously.

5.4.1.3 *Results required*

The frequency error shall be within ±1,5 kHz.

5.4.2 (4.3.2) *Effective radiated power*

5.4.2.1 *Definition*

The effective radiated power (e.r.p.) is the power radiated in the direction of the maximum field strength under specified conditions of measurement, in the absence of modulation.

5.4.2.2 *Method of measurement*

On a suitable test site the EUT shall be placed at a height of 1,5 m on a non-conducting support and in the configuration closest to normal use as declared by the manufacturer.

A test antenna shall be oriented for vertical polarization and the length of the test antenna shall be chosen to correspond to the frequency of the transmitter. The output of the test antenna shall be connected to a measuring receiver.

The transmitter shall be switched on, with the power reduction switch (when provided) in the maximum position, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter of the EUT. The test shall be conducted using channel 17.

The substitution antenna shall be raised and lowered to ensure that the maximum signal level is received.

The EUT shall then be rotated through 360° in the horizontal plane until the maximum level is detected by the measuring receiver. The maximum signal level shall be recorded.

The EUT shall be replaced by a suitable substitution antenna. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter of the EUT. The substitution antenna shall be connected to a calibrated signal generator.

The input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.

The test antenna shall be raised and lowered to ensure that the maximum signal is received.

The input signal to the substitution antenna shall be adjusted to the levels that produce levels, detected by the measuring receiver, that are equal to the levels recorded while the transmitter effective radiated powers were measured, corrected for the change of input attenuator setting of the measuring receiver.

The input levels to the substitution antenna shall be recorded as power levels, corrected for the change of input attenuator setting of the measuring receiver.

The measurements shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

The measurements shall be conducted under normal test conditions only.

The measure of the e.r.p. is the larger of the two power levels recorded, at the input to the substitution antenna, corrected for gain of the antenna if necessary.

5.4.2.3 *Results required*

The measured e.r.p. shall be between 0,25 W and 25 W.

When the e.r.p. exceeds 1 W the EUT shall have a power reduction switch.

5.4.3 (4.3.2) *Carrier power (referenced to e.r.p.)*

5.4.3.1 *Definition*

The carrier power referenced to e.r.p. is the mean power in the absence of modulation, delivered to the artificial antenna during one radio frequency cycle, corrected by the antenna gain.

The antenna gain is the difference in decibels between the e.r.p. measured in 5.4.2 and the carrier power delivered to the artificial antenna.

5.4.3.2 *Method of measurement*

The transmitter shall be connected to an artificial antenna and the output power delivered to this artificial antenna shall be measured.

To determine the antenna gain the measurement shall be made using channel 17 under normal test conditions.

The measurement shall be repeated using channel 16 under extreme test conditions as defined in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously.

The power reduction switch (when provided) shall be in the maximum position.

The carrier power measured, corrected for the antenna gain, shall be recorded as the e.r.p.

The test shall be repeated with the power reduction switch (when provided) in the minimum position.

5.4.3.3 *Results required*

The carrier power with the power reduction switch set at maximum shall remain between 0,25 W and 25 W.

The carrier power with the power reduction switch set at minimum shall remain between 0,25 W and 1,0 W.

5.4.4 (4.3.3) *Frequency deviation*

5.4.4.1 *Definition*

For the purpose of this standard, the frequency deviation is the difference between the instantaneous frequency of the modulated radio frequency signal and the carrier frequency.

5.4.4.2 *Maximum permissible frequency deviation*

5.4.4.2.1 *Method of measurement*

The frequency deviation shall be measured at the output with the transmitter connected to an artificial antenna, by means of a deviation meter capable of measuring the maximum deviation, including that due to any harmonics and intermodulation products which may be generated in the transmitter.

The modulation frequency shall be varied between 100 Hz and 3 kHz. The level of this test signal shall be 20 dB above the level which produces normal test modulation.

5.4.4.2.2 *Results required*

The maximum permissible frequency deviation shall be ±5 kHz.

5.4.4.3 *Reduction of frequency deviation at modulation frequencies above 3 kHz*

5.4.4.3.1 *Method of measurement*

The transmitter shall be operated under normal test conditions, and terminated with an artificial antenna. The transmitter shall be modulated with normal test modulation. With the modulation signal at a constant input level, the frequency shall be varied from 3 kHz to 25 kHz and the frequency deviation shall be measured.

5.4.4.3.2 *Results required*

For modulation frequencies between 3 kHz and 6 kHz the frequency deviation shall not exceed the frequency deviation with a modulation frequency of 3 kHz.

For a modulation frequency of 6 kHz, the frequency deviation shall not exceed ±1,5 kHz.

For modulation frequencies between 6 kHz and 25 kHz, the frequency deviation shall not exceed that given by a linear response of frequency deviation (in decibels) against modulation frequency, starting at the point where the modulation frequency is 6 kHz and the frequency deviation is ±1,5 kHz and inclined at 14 dB/octave, with the frequency deviation diminishing as the modulation frequency increases.

The required results are illustrated in figure 1.

5.4.5 (4.3.3) *Limitation characteristics of the modulator*

5.4.5.1 *Definition*

This characteristic expresses the capability of the transmitter to be modulated near the maximum permissible deviation specified in 5.4.4.2.2.

5.4.5.2 *Method of measurement*

A modulation signal at a frequency of 1 kHz shall be applied to the transmitter, and its level adjusted so that the frequency deviation is ±1 kHz. The level of the modulation signal shall then be increased by 20 dB and the deviation shall again be measured. This test shall be conducted under normal test conditions and extreme test conditions as defined in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously.

5.4.5.3 *Results required*

The frequency deviation shall be between ±3,5 kHz and ±5 kHz.

5.4.6 *Sensitivity of modulator, including microphone*

5.4.6.1 *Definition*

This characteristic expresses the capability of the transmitter to produce a sufficient modulation when an audiofrequency signal corresponding to the normal mean speech level is applied to the microphone.

5.4.6.2 *Method of measurement*

An acoustic signal with a frequency of 1 kHz and sound level of 94 dBA relative to 2×10^{-5} Pa shall be applied to the microphone. The resulting deviation shall be measured.

5.4.6.3 *Results required*

The resulting frequency deviation shall be between ±1,5 kHz and ±3 kHz.

5.4.7 *Audiofrequency response*

5.4.7.1 *Definition*

The audiofrequency response expresses the capability of the transmitter to operate without excessive degradation of the frequency response, as a function of the modulation frequency.

5.4.7.2 *Method of measurement*

A modulation signal, at a frequency of 1 kHz adjusted in level to produce a frequency deviation of ±1 kHz, is applied to the transmitter. The modulation frequency shall then be varied between 300 Hz and 3 kHz, keeping the audio input level constant.

5.4.7.3 *Results required*

The modulation index shall be constant and equal to its value at 1 kHz within the limits of +1 dB or –3 dB.

5.4.8 *Audiofrequency harmonic distortion of the emission*

5.4.8.1 *Definition*

The harmonic distortion of the emission modulated by an audiofrequency signal is defined as the ratio, expressed as the percentage, of the root mean square (r.m.s.) voltage of all the harmonic components of the fundamental frequency to the total r.m.s. voltage of the signal after linear demodulation.

5.4.8.2 *Method of measurement*

The RF signal produced by the transmitter shall be applied via an appropriate coupling device to a linear demodulator with a de-emphasis network of 6 dB/octave.

Under normal test conditions, the radio frequency signal shall be modulated successively at frequencies of 300 Hz and 1 kHz with a constant modulation index* of three. The distortion of the audiofrequency signal shall be measured at the frequencies specified above.

Under extreme test conditions as defined in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously, the measurements shall be carried out at 1 kHz with a frequency deviation of ±3 kHz.

5.4.8.3 *Results required*

The audiofrequency harmonic distortion shall not exceed 10 %.

5.4.9 *Adjacent channel power*

5.4.9.1 *Definition*

The adjacent channel power is the part of the total power output of a transmitter under defined conditions of modulation, which falls within a specified passband centered on the nominal frequency of either of the adjacent channels. This power is the sum of the mean power produced by the modulation, hum and noise of the transmitter.

* Modulation index is the ratio between the frequency deviation and the modulation frequency.

5.4.9.2 *Method of measurement*

The adjacent channel power shall be measured with a power measuring receiver, referred to as the "receiver", which consists of a mixer, an IF filter, an oscillator, an amplifier, a variable attenuator and an r.m.s. value indicator. Instead of the variable attenuator with the r.m.s. value indicator it is possible to use an r.m.s voltmeter calibrated in decibels. The technical characteristics of the power measuring receiver are given in annex A.

a) The transmitter shall be operated at the carrier power determined in 5.4.3 under normal test conditions. The output of the transmitter shall be linked to the input of the "receiver" by a connecting device such that the impedance presented to the transmitter is 50 Ω and the level at the "receiver" input is appropriate.

b) With the transmitter unmodulated*, the tuning of the "receiver" shall be adjusted so that a maximum response is obtained. This is the 0 dB response point. The "receiver" attenuator setting and the reading of the meter shall be recorded.

c) The tuning of the "receiver" shall be adjusted away from the carrier so that the "receiver" – 6 dB response nearest to the transmitter carrier frequency is located at a displacement from the nominal carrier frequency of 17 kHz.

d) The transmitter shall be modulated with 1,25 kHz at a level which is 20 dB higher than that required to produce a ±3 kHz deviation.

e) The "receiver" variable attenuator shall be adjusted to obtain the same meter reading as in step b) or a known relation to it.

f) The ratio of adjacent channel power to carrier power is the difference between the attenuator settings in steps b) and e), corrected for any differences in the reading of the meter.

g) The measurement shall be repeated with the "receiver" tuned to the other side of the carrier.

5.4.9.3 *Results required*

The adjacent channel power shall not exceed a value of 70 dB below the carrier power of the transmitter or 0,2 μW, whichever is higher.

5.4.10 (4.3.5) *Conducted spurious emissions conveyed to the antenna*

5.4.10.1 *Definition*

Conducted 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.

5.4.10.2 *Method of measurement*

Conducted spurious emissions shall be measured with the unmodulated transmitter connected to the artificial antenna. The measurement shall extend over a frequency range from 150 kHz to 2 GHz, excluding the channel on which the transmitter is operating and its adjacent channels.

* The measurement may be made with the transmitter modulated with normal test modulation, in which case this fact shall be recorded with the test results.

5.4.10.3 *Results required*

The power of any spurious emission on any discrete frequency shall not exceed 0,25 µW in the frequency range 150 kHz to 1 GHz and 1 µW in the frequency range 1 GHz to 2 GHz.

5.4.11 *Residual modulation of the transmitter*

5.4.11.1 *Definition*

The residual modulation of the transmitter is the ratio, in decibels, of the demodulated radio frequency signal in the absence of wanted modulation, to the modulated radio frequency signal produced when the normal test modulation is applied.

5.4.11.2 *Method of measurement*

The normal test modulation shall be applied to the transmitter. The radio frequency signal produced by the transmitter shall be applied, via an appropriate coupling device, to a linear demodulator with a de-emphasis network of 6 dB/octave. Precautions shall be taken to avoid the effects of emphasizing the low audio frequencies produced by internal noise.

The signal shall be measured by using an r.m.s. voltmeter. The modulation shall then be switched off and the level of the residual audiofrequency signal at the output shall be measured again.

5.4.11.3 *Results required*

The residual modulation shall not exceed –40 dB.

5.4.12 *Transient frequency behaviour of the transmitter*

5.4.12.1 *Definition*

The transient frequency behaviour of the transmitter is the variation in time of the transmitter frequency difference from the nominal frequency of the transmitter when the RF output power is switched on and off (see figure 2).

t_{on}: according to the method of measurement described in 5.4.12.2 the switch-on instant t_{on} of a transmitter is defined by the condition when the output power, measured at the antenna terminal, exceeds 0,1 % of the nominal power;

t_1: period of time starting at t_{on} and finishing according to table 1;

t_2: period of time starting at the end of t_1 and finishing according to table 1;

t_{off}: switch-off instant defined by the condition when the output power falls below 0,1 % of the nominal power;

t_3: period of time finishing at t_{off} and starting according to table 1.

Table 1 – Transmitter transient timing (ms)

t_1	5,0
t_2	20,0
t_3	5,0

NOTES

1 During the periods t_1 and t_3 the frequency difference shall not exceed the value of 1 channel separation.

2 During the period t_2 the frequency difference shall not exceed the value of half a channel separation.

5.4.12.2 *Method of measurement*

Two signals shall be connected to the test discriminator via a combining network. The transmitter shall be connected to a 50 Ω power attenuator. The output of the power attenuator shall be connected to the test discriminator via one input of the combining network.

A test signal generator shall be connected to the second input of the combining network. The test signal shall be adjusted to the nominal frequency of the transmitter. The test signal shall be modulated by a frequency of 1 kHz with a deviation of ±25 kHz.

The test signal level shall be adjusted to correspond to 0,1 % of the power of the transmitter under test measured at the input of the test discriminator. This level shall be maintained throughout the measurement.

The amplitude difference (ad) (see figure 3) and the frequency difference (fd) (see figure 3) output of the test discriminator shall be connected to a storage oscilloscope. The storage oscilloscope shall be set to display the channel corresponding to the (fd) input up to ±1 channel frequency difference, corresponding to the relevant channel separation, from the nominal frequency.

The storage oscilloscope shall be set to a sweep rate of 1 ms/division and set so that the triggering occurs at 1 division from the left edge of the display. The display will show the 1 kHz test signal continuously. The storage oscilloscope shall then be set to trigger on the channel corresponding to the amplitude difference (ad) input at a low level, rising.

The transmitter shall then be switched on, without modulation, to produce the trigger pulse and a picture on the display. The result of the change in the ratio of power between the test signal and the transmitter output will, due to the capture ratio of the test discriminator, produce two separate sides on the picture, one showing the 1 kHz test signal, the other the frequency of the transmitter versus time.

The moment when the 1 kHz test signal is completely suppressed is considered to provide t_{on}. The period of time t_1 and t_2 as defined in table 1 shall be used to define the appropriate template.

The result shall be recorded as frequency difference versus time.

The transmitter shall remain switched on.

The storage oscilloscope shall be set to trigger on the channel corresponding to the amplitude difference (ad) input at a high level, decaying and set so that the triggering occurs at 1 division from the right edge of the display.

The transmitter shall then be switched off. The moment when the 1 kHz test signal starts to rise is considered to provide t_{off}. The period of time t_3 as defined in table 1 shall be used to define the appropriate template.

The result shall be recorded as frequency difference versus time.

5.4.12.3 *Results required*

During the period of time t_1 and t_3 the frequency difference shall not exceed the value of 1 channel separation. The frequency difference, after the end of t_2, shall be within the limit of the frequency error of 5.4.1.3.

During the period of time t_2 the frequency difference shall not exceed the value of ½ channel separation. Before the start of t_3 the frequency difference shall be within the limit of the frequency error of 5.4.1.3.

The required results are illustrated in figure 2.

5.5 *Receiver*

The performance requirements and technical characteristics in this standard shall be verified according to the test procedures described below.

5.5.1 (4.4.3) *Harmonic distortion and rated audiofrequency output power*

5.5.1.1 *Definition*

The harmonic distortion at the receiver output is defined as the ratio, expressed as a percentage, of the total r.m.s. voltage of all the harmonic components of the modulation audiofrequency to the total r.m.s. voltage of the signal delivered by the receiver. The rated audiofrequency output power is the value stated by the manufacturer to be the maximum power available at the output, for which all the requirements of this standard are met.

5.5.1.2 *Method of measurement*

A test signal of +100 dBμV, at a carrier frequency equal to the nominal frequency of the receiver and modulated by the normal test modulation shall be applied to the receiver input.

For the measurement, the audiofrequency output power control of the receiver shall be set so as to obtain, in a resistive load which simulates the operating load of the receiver, the rated audiofrequency output power. The value of this load shall be stated by the manufacturer.

Under normal test conditions, the test signal shall be modulated successively at 300 Hz and 1 kHz with a constant modulation index* of three. The harmonic distortion and audiofrequency output power shall be measured at all the frequencies specified above.

Under extreme test conditions as defined in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously, the test shall be made at the nominal frequency of the receiver and at the nominal frequency ±1,5 kHz. For these tests, the modulation frequency shall be 1 kHz and the frequency deviation shall be ±3 kHz.

5.5.1.3 *Results required*

The rated audiofrequency output power shall be at least 200 mW in the loudspeaker and 1 mW in a headset or earphone if provided.

The harmonic distortion shall not exceed 10 %.

5.5.2 (4.2) *Audiofrequency response*

5.5.2.1 *Definition*

The audiofrequency response is defined as the variation in the audiofrequency output level of the receiver as a function of the modulation frequency of the radiofrequency signal with constant deviation at the input.

* Modulation index is the ratio between the frequency deviation and the modulation frequency.

5.5.2.2 *Method of measurement*

A test signal of +60 dBμV, at a carrier frequency equal to the nominal frequency of the receiver, shall be applied to the receiver input. The audiofrequency power control of the receiver shall be set so as to produce a level equal to 50 % of the rated audiofrequency output power (see 5.5.1.1) when normal test modulation is applied in accordance with 5.2.3. This setting shall remain unchanged during the test.

The frequency deviation shall then be reduced to ±1 kHz. The frequency deviation shall remain constant while the modulation frequency is varied between 300 Hz and 3 kHz, and the output level shall then be measured. The measurement shall be repeated with a test signal at the same frequency as the nominal frequency of the receiver ±1,5 kHz.

5.5.2.3 *Results required*

The receiver response shall not deviate by more than +1 dB or –3 dB from a characteristic giving the output level as a function of the audiofrequency, decreasing by 6 dB/octave and passing through the measured point at 1 kHz.

The required limits are illustrated in figure 4.

5.5.3 (4.4.1) *Maximum usable sensitivity*

5.5.3.1 *Definition*

The maximum usable sensitivity is the minimum level of the signal (e.m.f.) at the nominal frequency of the receiver which, when applied to the receiver input with normal test modulation, will produce at the receiver output in all cases, an audiofrequency output power equal to 50 % of the rated output power and a SINAD ratio, psophometrically weighted, of 20 dB.

5.5.3.2 *Method of measurement*

A test signal at a carrier frequency equal to the nominal frequency of the receiver, modulated by the normal test modulation shall be applied to the receiver input. An audiofrequency load and a measuring instrument for measuring the SINAD ratio through the psophometric network shall be connected to the receiver output terminals.

The level of the test signal shall be adjusted until a SINAD ratio of 20 dB is obtained and with the audiofrequency power control of the receiver adjusted to produce 50 % of the rated output power. Under these conditions, the level of the test signal at the input is the value of the maximum usable sensitivity.

The measurement shall be carried out under normal test conditions and extreme test conditions as defined in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously.

A receiver audiofrequency output power variation of up to ±3 dB relative to 50 % of the rated output power shall be allowed for sensitivity measurements under extreme test conditions.

5.5.3.3 *Results required*

The maximum usable sensitivity shall not exceed +6 dBμV under normal test conditions and +12 dBμV under extreme test conditions.

5.5.4 (4.4.2) *Co-channel rejection ratio*

5.5.4.1 *Definition*

The co-channel rejection ratio is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

5.5.4.2 *Method of measurement*

The two input signals shall be connected to the receiver via a combining network. The wanted signal shall have normal test modulation. The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz. Both input signals shall be at the nominal frequency of the receiver under test and the measurement shall be repeated for displacements of the unwanted signal of up to ±3 kHz.

The wanted input signal level shall be set to the value corresponding to the maximum usable sensitivity, as measured in 5.5.3.3 under normal test conditions. The amplitude of the unwanted input signal shall then be adjusted until the SINAD ratio at the receiver audiofrequency output, psophometrically weighted, is reduced to 14 dB.

The co-channel rejection ratio shall be expressed as the ratio in decibels, of the level of the unwanted signal to the level of the wanted signal at the receiver input, for which the specified reduction in SINAD ratio occurs.

5.5.4.3 *Results required*

The co-channel rejection ratio shall be between –10 dB and 0 dB.

5.5.5 (4.4.5) *Adjacent channel selectivity*

5.5.5.1 *Definition*

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal which differs in frequency from the wanted signal by 25 kHz.

5.5.5.2 *Method of measurement*

The two input signals shall be applied to the receiver input via a combining network. The wanted signal shall be at the nominal frequency of the receiver and shall have normal test modulation. The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz, and shall be at the frequency of the channel immediately above that of the wanted signal.

The wanted input signal level shall be set to the value corresponding to the maximum usable sensitivity, as measured in 5.5.3.3. The amplitude of the unwanted input signal shall then be adjusted until the SINAD ratio at the receiver audiofrequency output, psophometrically weighted, is reduced to 14 dB. The measurement shall be repeated with an unwanted signal at the frequency of the channel below that of the wanted signal.

The adjacent channel selectivity shall be expressed as the lower value of the ratio in decibels for the upper and lower adjacent channels of the level of the unwanted signal to the level of the wanted signal.

The measurement shall then be repeated under extreme test conditions as defined in IEC 945, of dry heat and the upper limit of supply voltage applied simultaneously and low temperature and the lower limit of supply voltage applied simultaneously, with the wanted signal set to the value corresponding to the maximum usable sensitivity under extreme test conditions.

5.5.5.3 *Results required*

The adjacent channel selectivity shall be not less than 70 dB under normal test conditions and not less than 60 dB under extreme test conditions.

5.5.6 (4.4.6) *Spurious response rejection*

5.5.6.1 *Definition*

The spurious response rejection is a measure of the capability of the receiver to discriminate between the wanted modulated signal at the nominal frequency and an unwanted signal at any other frequency at which a response is obtained.

5.5.6.2 *Method of measurement*

Two input signals shall be applied to the receiver input via a combining network. The wanted signal shall be at the nominal frequency of the receiver and shall have normal test modulation. The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz.

The wanted input signal level shall be set to the value corresponding to the maximum usable sensitivity, as measured in 5.5.3.3. The amplitude of the unwanted input signal shall be adjusted to +86 dBμV. The frequency shall then be swept over the frequency range from 100 kHz to 2 GHz.

At any frequency at which a response is obtained, the input level shall be adjusted until the SINAD ratio at the receiver audiofrequency output, psophometrically weighted, is reduced to 14 dB.

The spurious response rejection ratio shall be expressed as the ratio in decibels between the unwanted signal and the wanted signal at the receiver input when the specified reduction in the SINAD ratio is obtained.

5.5.6.3 *Results required*

At any frequency separated from the nominal frequency of the receiver by more than 25 kHz, the spurious response rejection shall be not less than 70 dB.

5.5.7 (4.4.7) *Intermodulation response*

5.5.7.1 *Definition*

The intermodulation response is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with specific frequency relationship to the wanted signal frequency.

5.5.7.2 *Method of measurement*

Three signal generators A, B and C shall be connected to the receiver via a combining network. The wanted signal, represented by signal generator A shall be set at the nominal frequency of the receiver and shall have normal test modulation. The unwanted signal from signal generator B shall be unmodulated and adjusted to a frequency 50 kHz above or below the nominal frequency of the receiver. The second unwanted signal from signal generator C shall be modulated by 400 Hz with a deviation of ±3 kHz, and adjusted to a frequency 100 kHz above or below the nominal frequency of the receiver.

The wanted input signal shall be set to a value corresponding to the maximum usable sensitivity, as measured in 5.5.3.3. The amplitude of the two unwanted signals shall be maintained equal and shall be adjusted until the SINAD ratio at the receiver audiofrequency output, psophometrically weighted, is reduced to 14 dB. The frequency of signal generator B shall be adjusted to produce the maximum degradation to the SINAD ratio. The level of the two unwanted test signals shall be readjusted to restore the SINAD ratio of 14 dB.

The intermodulation response ratio shall be expressed as the ratio in decibels between the two unwanted signals and the wanted signal at the receiver input, when the specified reduction in the SINAD ratio is obtained.

5.5.7.3 *Results required*

The intermodulation response ratio shall be not less than 65 dB.

5.5.8 (4.4.2) *Blocking*

5.5.8.1 *Definition*

Blocking is a change (generally a reduction) in the audiofrequency output power of the receiver or a reduction of the SINAD ratio due to an unwanted signal on another frequency.

5.5.8.2 *Method of measurement*

Two input signals shall be applied to the receiver via a combining network. The modulated wanted signal shall be at the nominal frequency of the receiver and shall have normal test modulation. Initially the unwanted signal shall be switched off and the wanted signal set to the value corresponding to the maximum usable sensitivity, as measured in 5.5.3.3.

The audiofrequency output power of the wanted signal shall be adjusted, where possible, to 50 % of the rated output power and in the case of stepped power controls, to the first step that provides an output power of at least 50 % of the rated output power. The unwanted signal shall be unmodulated and the frequency shall be swept between +1 MHz and +10 MHz, and also –1 MHz and –10 MHz, relative to the nominal frequency of the receiver.

The input level of the unwanted signal, at all frequencies in the specified ranges, shall be adjusted so that the unwanted signal causes a reduction of 3 dB in the output level of the wanted signal or a reduction to 14 dB of the SINAD ratio at the receiver audiofrequency output, psophometrically weighted, whichever occurs first.

This level expressed in dBμV shall be noted.

5.5.8.3 *Results required*

The blocking level for any frequency within the specified ranges shall be not less than +90 dBμV, except at frequencies at which spurious responses are found (see 5.5.6).

5.5.9 (4.4.8) *Conducted spurious emissions conveyed to the antenna*

5.5.9.1 *Definition*

Conducted spurious emissions to the antenna are any RF emissions generated in the receiver and conveyed to the antenna terminal.

5.5.9.2 *Method of measurement*

Conducted spurious emissions shall be measured as the power level of any frequency component at the antenna terminals of the receiver. The receiver antenna terminals are connected to a spectrum analyzer or selective voltmeter having an input impedance of 50 Ω and the receiver is switched on.

If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by a substitution method using a signal generator. The measurement shall extend over the frequency range 150 kHz to 2 GHz.

5.5.9.3 *Results required*

The power of any spurious emission in the specified range at the antenna terminal shall not exceed –57 dBm (2 nW) in the frequency range 150 kHz to 1 GHz and –37 dBm (20 nW) in the frequency range 1 GHz to 2 GHz.

5.5.10 *Amplitude response of the receiver limiter*

5.5.10.1 *Definition*

The amplitude characteristic of the receiver limiter is the relationship between the radio-frequency input level of a specific modulated signal and the audiofrequency level of the receiver output.

5.5.10.2 *Method of measurement*

A test signal at the nominal frequency of the receiver and modulated by the normal test modulation at a level of +6 dBμV shall be applied to the receiver input and the audiofrequency output power level shall be adjusted to a level of 6 dB lower than the rated output power. The level of the input signal shall be increased to +100 dBμV and the audiofrequency output power level shall be measured again.

5.5.10.3 *Results required*

When the level of the input signal is varied as specified, the variation between the maximum and minimum value of the audiofrequency output power level shall not exceed 3 dB.

5.5.11 *Receiver hum and noise level*

5.5.11.1 *Definition*

The receiver hum and noise level is defined as the ratio, in decibels, of the audiofrequency power of the hum and noise resulting from the spurious effects of the power supply system or from other causes, to the audiofrequency power produced by a high frequency signal of average level, modulated by the normal test modulation and applied to the receiver input.

5.5.11.2 *Method of measurement*

The test signal with a level of +30 dBμV at a carrier frequency equal to the nominal frequency of the receiver, and modulated by the normal test modulation shall be applied to the receiver input. An audiofrequency load shall be connected to the output terminal of the receiver. The audiofrequency power control shall be set so as to produce the rated output power level conforming to 5.5.1.3.

The output signal shall be measured by means of an r.m.s. voltmeter. The modulation shall then be switched off and the audiofrequency output level shall be measured again.

5.5.11.3 *Results required*

The hum and noise level of the receiver shall not exceed –40 dB.

5.5.12 (3.3.2.3) *Squelch operation*

5.5.12.1 *Definition*

The purpose of the squelch facility is to mute the audio output signal of the receiver when the level of the signal at the receiver input is less than a given value.

5.5.12.2 *Method of measurement*

a) With the squelch facility switched off, a test signal of +30 dBμV, at a carrier frequency equal to the nominal frequency of the receiver and modulated by the normal test modulation shall be applied to the input terminals of the receiver. An audiofrequency load and the psophometric filtering network shall be connected to the output terminals of the receiver. The audiofrequency power output control of the receiver shall be set so as to produce the rated audiofrequency output power defined in 5.5.1.3.

The output signal shall be measured with an r.m.s. voltmeter. The input signal shall then be suppressed, the squelch facility switched on and the audiofrequency output power level shall be measured again.

b) With the squelch facility switched off again, a test signal modulated by the normal test modulation shall be applied to the receiver input at a level of +6 dBμV and the receiver shall be set to produce 50 % of the rated audiofrequency output power.

The level of the input signal shall then be reduced and the squelch facility shall be switched on. The input signal shall then be increased until the above-mentioned audiofrequency output power is reached. The SINAD ratio and the input level shall then be measured.

c) This test is only applicable to equipment with a continuously adjustable squelch control. With the squelch facility switched off, a test signal with normal test modulation shall be applied to the receiver input at a level of +6 dBμV, and the receiver shall be adjusted to give 50 % of the rated audiofrequency output power.

The squelch facility shall then be switched on at its maximum position and the level of the input signal shall be increased until the output again is 50 % of the rated audiofrequency output power.

5.5.12.3 *Results required*

a) Under the conditions specified in 5.5.12.2.a), the audiofrequency output power shall not exceed –40 dB relative to the rated audiofrequency output power.

b) Under the conditions specified in 5.5.12.2.b), the input signal level shall not exceed +6 dBμV and SINAD ratio shall be at least 20 dB.

c) Under the conditions specified in 5.5.12.2.c), the input signal level shall not exceed +6 dBμV when the control is set at maximum.

5.5.13 *Squelch hysteresis*

5.5.13.1 *Definition*

Squelch hysteresis is the difference in decibels between the receiver input signal levels at which the squelch opens and closes.

5.5.13.2 *Method of measurement*

If there is any squelch control on the exterior of the equipment, it shall be placed in its maximum muted position. With the squelch facility switched on, an unmodulated input signal at a carrier frequency equal to the nominal frequency of the receiver shall be applied to the input of the receiver at a level sufficiently low to avoid opening the squelch.

The input signal shall be increased to the level just opening the squelch. This level shall be recorded. With the squelch still open, the level of the input signal shall be slowly decreased until the squelch mutes the receiver audio output again. This level shall be recorded.

5.5.13.3 *Results required*

The squelch hysteresis shall be between 3 dB and 6 dB.

5.6 *Battery charger*

If the equipment is powered by a secondary battery, the associated battery charger shall comply with the requirements of 3.1.2 of IEC 945.

5.7 (3.5) *Electromagnetic compatibility*

5.7.1 *Conducted spurious emissions*

Conducted spurious emissions shall be determined as specified in IEC 945 and comply to the limits contained therein. This test only applies to the battery charger when provided.

5.7.2 (4.3.6) *Radiated spurious emission*

Radiated spurious emissions shall be determined as specified in IEC 945 and comply to the limits contained therein. This test applies to the EUT and its battery charger when provided.

5.7.3 (4.4.2) *Immunity to electromagnetic environment*

Tests for immunity to the electromagnetic environment as applicable shall be performed as specified in IEC 945.

The EUT and its battery charger when provided shall be tested for immunity to radiated interference and immunity to electrostatic discharge. The battery charger when provided shall additionally be tested for immunity to conducted audiofrequencies and to conducted radio-frequencies.

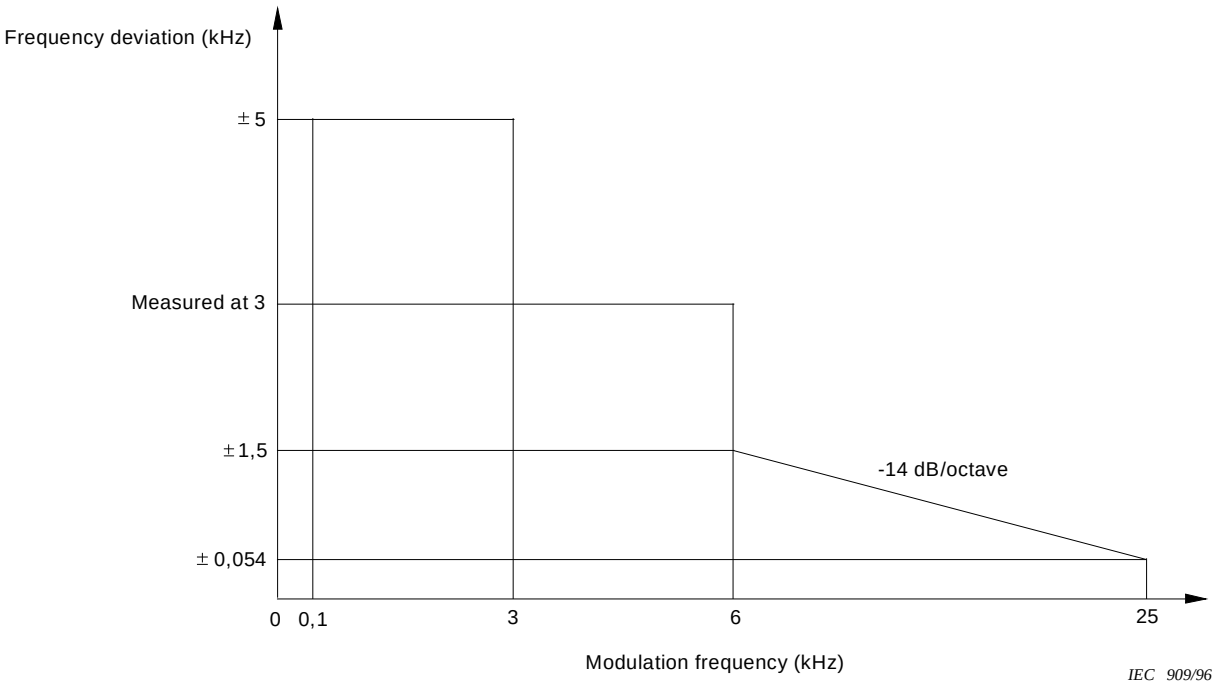
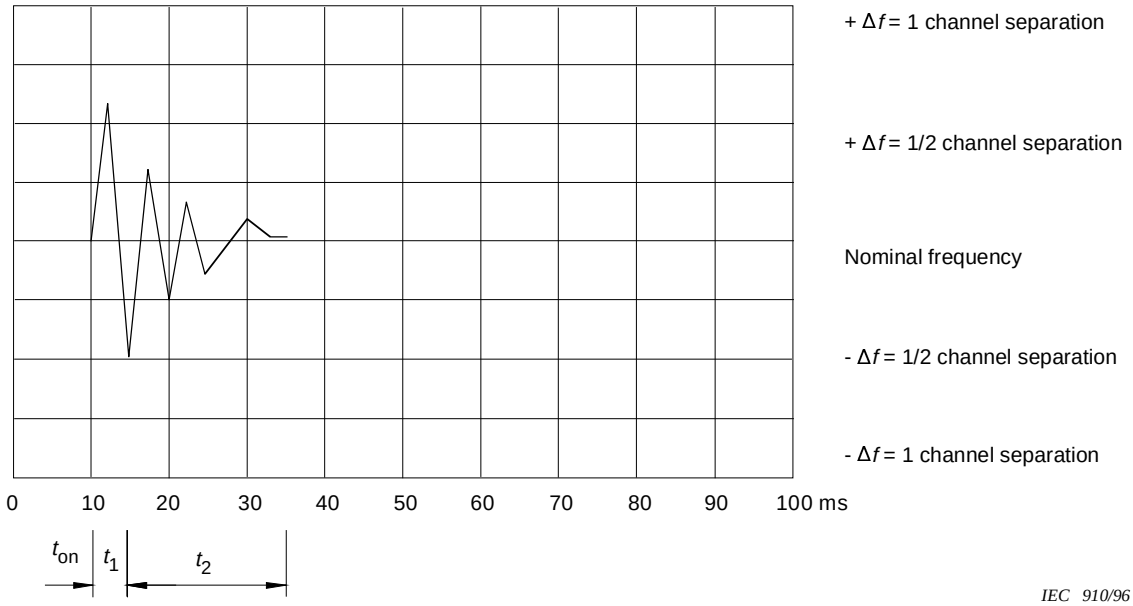


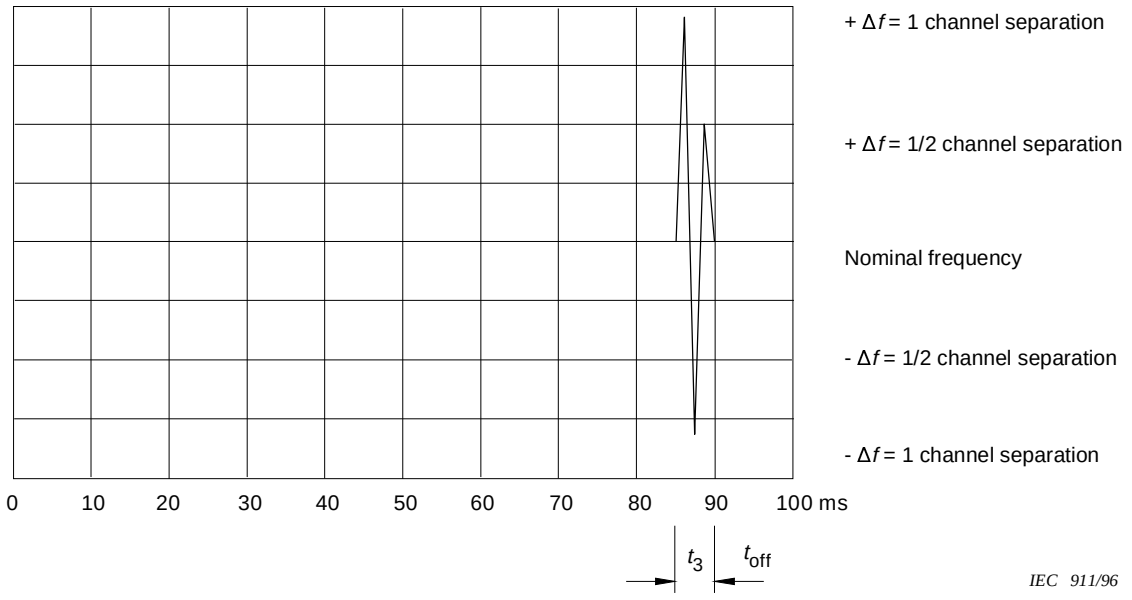
Figure 1 – Transmitter permissible frequency deviation

Switch-on condition t_{on}, t_1 and t_2



IEC 910/96

Switch-off condition t_3, t_{off}



IEC 911/96

Figure 2 – Storage oscilloscope view t_1, t_2 and t_3

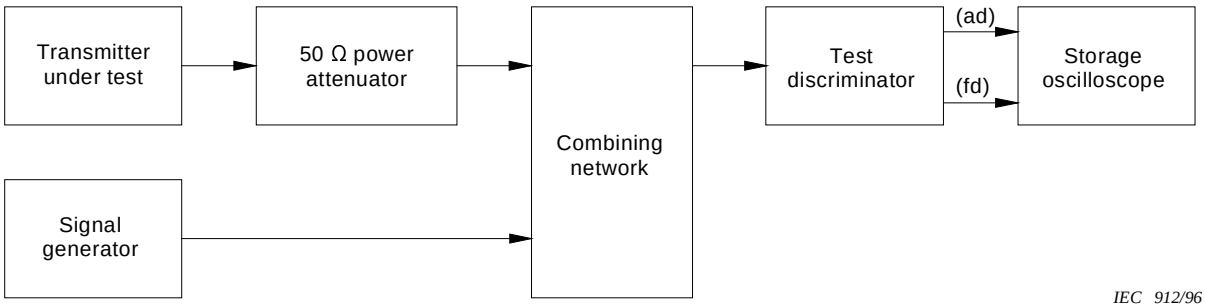


Figure 3 – Test set-up for measuring transient frequency behaviour

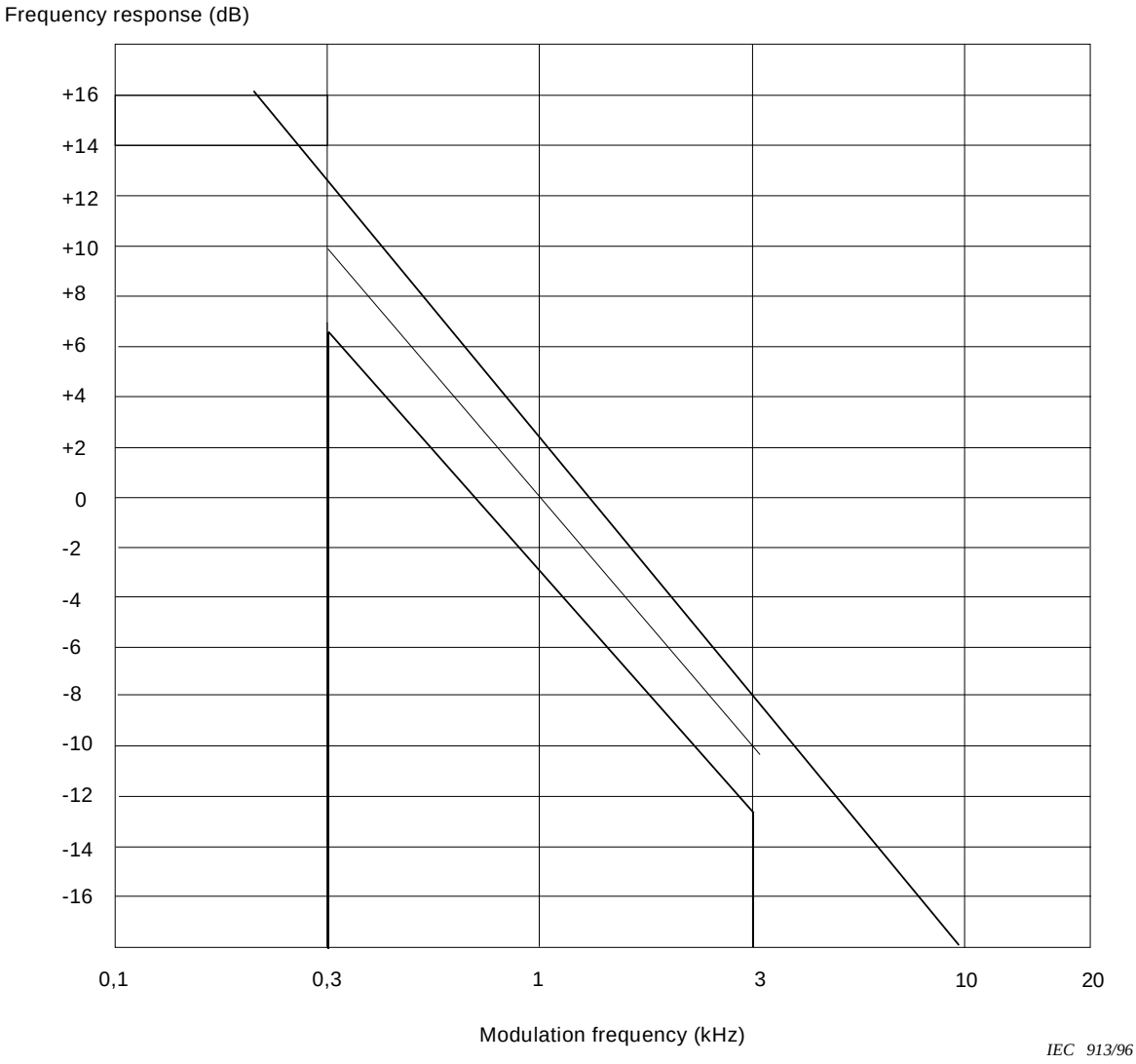


Figure 4 – Receiver audiofrequency response

Annex A
(normative)

Power measuring receiver specification

A.1 IF filter

The IF filter shall be within the limits specified in the following figure A.1:

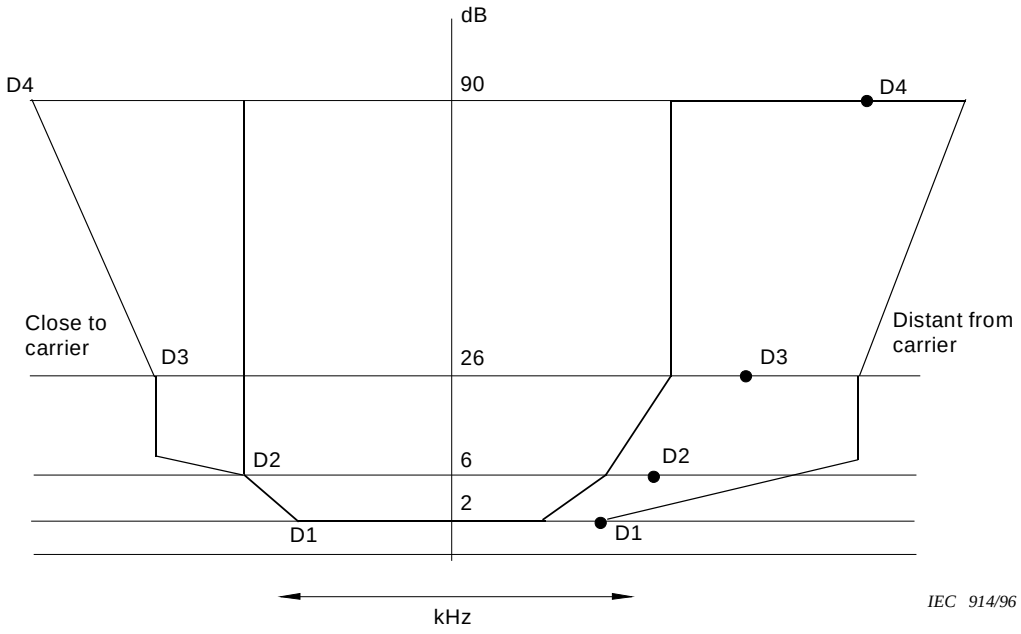


Figure A.1 – IF filter specification

The selectivity characteristics shall maintain the following frequency separations from the nominal centre frequency of the adjacent channel given in table A.1.

Table A.1 – Selectivity characteristic

Frequency separation of filter curve from nominal centre frequency of adjacent channel kHz			
D1	D2	D3	D4
5	8,0	9,25	13,25

The attenuation points shall not exceed the following tolerances:

Table A.2 – Attenuation points close to carrier

Tolerance range kHz			
D1	D2	D3	D4
+3,1	±0,1	–1,35	–5,35

Table A.3 – Attenuation points distant from carrier

Tolerance range kHz			
D1	D2	D3	D4
±3,5	±3,5	±3,5	+3,5 –7,5

The minimum attenuation of the filter outside the 90 dB attenuation points shall be equal to or greater than 90 dB.

A.2 Attenuation indicator

The attenuation indicator shall have a minimum range of 80 dB and a reading accuracy of 1 dB. With a view to future regulations an attenuation of 90 dB or more is recommended.

A.3 RMS value indicator

The instrument shall accurately indicate non-sinusoidal signals in a ratio up to 10:1 between peak value and r.m.s. value.

A.4 Oscillator and amplifier

The oscillator and the amplifier shall be designed in such a way that measurement of the adjacent channel power of a low-noise unmodulated transmitter, whose self-noise has a negligible influence on the measurement results, yields a measured value of < –90 dB.

Annex B
(normative)

Simulated solar radiation source

The irradiance at the EUT surface shall be 1 120 kW/m^2 ± 10 % with a spectral distribution given in table B below.

The value of 1 120 kW/m^2 shall include any radiation reflected from the enclosure.

Table B.1 – Spectral energy distribution and permitted tolerances

Spectral region	Ultra-violet B*	Ultra-violet A	Visible			Infra-red
Bandwidth (mm)	0,28 – 0,32	0,32 – 0,40	0,40 – 0,52	0,52 – 0,64	0,64 – 0,78	0,78 – 3,00
Irradiance (W/m^2)	5	63	200	186	174	492
Tolerance (%)	±35	±25	±10			±20
* Radiation shorter than 0,30 mm reaching the earth's surface is insignificant.						

Annex C
(informative)

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———————

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Would you please take a minute to answer the survey on the other side and mail or fax to:

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or

Fax to: CSC at +41 22 919 03 00

Thank you for your contribution to the standards making process.

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Ne pas affranchir

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No stamp required

A Prioritaire

RÉPONSE PAYÉE

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International Electrotechnical Commission
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Case postale 131
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Switzerland

1.

No. of IEC standard:

.....

2.

Tell us why you have the standard. (check many as apply). I am:

- ☐ the buyer
- ☐ the user
- ☐ a librarian
- ☐ a researcher
- ☐ an engineer
- ☐ a safety expert
- ☐ involved in testing
- ☐ with a government agency
- ☐ in industry
- ☐ other.....

3.

This standard was purchased from?

.....

4.

This standard will be used (check as many as apply):

- ☐ for reference
- ☐ in a standards library
- ☐ to develop a new product
- ☐ to write specifications
- ☐ to use in a tender
- ☐ for educational purposes
- ☐ for a lawsuit
- ☐ for quality assessment
- ☐ for certification
- ☐ for general information
- ☐ for design purposes
- ☐ for testing
- ☐ other.....

5.

This standard will be used in conjunction with (check as many as apply):

- ☐ IEC
- ☐ ISO
- ☐ corporate
- ☐ other (published by.....)
- ☐ other (published by.....)
- ☐ other (published by.....)

6.

This standard meets my needs (check one)

- ☐ not at all
- ☐ almost
- ☐ fairly well
- ☐ exactly

7.

Please rate the standard in the following areas as (1) bad, (2) below average, (3) average, (4) above average, (5) exceptional, (0) not applicable:

- ☐ clearly written
- ☐ logically arranged
- ☐ information given by tables
- ☐ illustrations
- ☐ technical information

8.

I would like to know how I can legally reproduce this standard for:

- ☐ internal use
- ☐ sales information
- ☐ product demonstration
- ☐ other.....

9.

In what medium of standard does your organization maintain most of its standards (check one):

- ☐ paper
- ☐ microfilm/microfiche
- ☐ mag tapes
- ☐ CD-ROM
- ☐ floppy disk
- ☐ on line

9A.

If your organization currently maintains part or all of its standards collection in electronic media please indicate the format(s):

- ☐ raster image
- ☐ full text

10.

In what medium does your organization intend to maintain its standards collection in the future (check all that apply):

- ☐ paper
- ☐ microfilm/microfiche
- ☐ mag tape
- ☐ CD-ROM
- ☐ floppy disk
- ☐ on line

10A.

For electronic media which format will be chosen (check one)

- ☐ raster image
- ☐ full text

11.

My organization is in the following sector (e.g. engineering, manufacturing)

.....

12.

Does your organization have a standards library:

- ☐ yes
- ☐ no

13.

If you said yes to 12 then how many volumes:

.....

14.

Which standards organizations published the standards in your library (e.g. ISO, DIN, ANSI, BSI, etc.):

.....

15.

My organization supports the standards-making process (check as many as apply):

- ☐ buying standards
- ☐ using standards
- ☐ membership in standards organization
- ☐ serving on standards development committee
- ☐ other.....

16.

My organization uses (check one)

- ☐ French text only
- ☐ English text only
- ☐ Both English/French text

17.

Other comments:

.....

.....

.....

.....

.....

.....

18.

Please give us information about you and your company

name: .....

job title:.....

company: .....

address:.....

.....

.....

.....

No. employees at your location:.....

turnover/sales:.....

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La CEI se préoccupe de savoir comment ses normes sont accueillies et utilisées.

Les réponses que nous procurera cette enquête nous aideront tout à la fois à améliorer nos normes et les informations qui les concernent afin de toujours mieux répondre à votre attente.

Nous aimerions que vous nous consacriez une petite minute pour remplir le questionnaire joint que nous vous invitons à retourner au:

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Suisse

Télécopie: IEC/CSC +41 22 919 03 00

Nous vous remercions de la contribution que vous voudrez bien apporter ainsi à la Normalisation Internationale

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Case postale 131
1211 GENÈVE 20
Suisse

1.

Numéro de la Norme CEI:

.....

2.

Pourquoi possédez-vous cette norme? (plusieurs réponses possibles). Je suis:

- ☐ l'acheteur
- ☐ l'utilisateur
- ☐ bibliothécaire
- ☐ chercheur
- ☐ ingénieur
- ☐ expert en sécurité
- ☐ chargé d'effectuer des essais
- ☐ fonctionnaire d'Etat
- ☐ dans l'industrie
- ☐ autres.....

3.

Où avez-vous acheté cette norme?

.....

4.

Comment cette norme sera-t-elle utilisée? (plusieurs réponses possibles)

- ☐ comme reférence
- ☐ dans une bibliothèque de normes
- ☐ pour développer un produit nouveau
- ☐ pour rédiger des spécifications
- ☐ pour utilisation dans une soumission
- ☐ à des fins éducatives
- ☐ pour un procès
- ☐ pour une évaluation de la qualité
- ☐ pour la certification
- ☐ à titre d'information générale
- ☐ pour une étude de conception
- ☐ pour effectuer des essais
- ☐ autres.....

5.

Cette norme est-elle appelée à être utilisée conjointement avec d'autres normes? Lesquelles? (plusieurs réponses possibles):

- ☐ CEI
- ☐ ISO
- ☐ internes à votre société
- ☐ autre (publiée par).....)
- ☐ autre (publiée par).....)
- ☐ autre (publiée par).....)

6.

Cette norme répond-elle à vos besoins?

- ☐ pas du tout
- ☐ à peu près
- ☐ assez bien
- ☐ parfaitement

7.

Nous vous demandons maintenant de donner une note à chacun des critères ci-dessous (1, mauvais; 2, en-dessous de la moyenne; 3, moyen; 4, au-dessus de la moyenne; 5, exceptionnel; 0, sans objet)

- ☐ clarté de la rédaction
- ☐ logique de la disposition
- ☐ tableaux informatifs
- ☐ illustrations
- ☐ informations techniques

8.

J'aimerais savoir comment je peux reproduire légalement cette norme pour:

- ☐ usage interne
- ☐ des renseignements commerciaux
- ☐ des démonstrations de produit
- ☐ autres .....

9.

Quel support votre société utilise-t-elle pour garder la plupart de ses normes?

- ☐ papier
- ☐ microfilm/microfiche
- ☐ bandes magnétiques
- ☐ CD-ROM
- ☐ disquettes
- ☐ abonnement à un serveur électronique

9A.

Si votre société conserve en totalité ou en partie sa collection de normes sous forme électronique, indiquer le ou les formats:

- ☐ format tramé (ou image balayée ligne par ligne)
- ☐ texte intégral

10.

Sur quels supports votre société prévoit-elle de conserver sa collection de normes à l'avenir (plusieurs réponses possibles):

- ☐ papier
- ☐ microfilm/microfiche
- ☐ bandes magnétiques
- ☐ CD-ROM
- ☐ disquettes
- ☐ abonnement à un serveur électronique

10A.

Quel format serait retenu pour un moyen électronique? (une seule réponse)

- ☐ format tramé
- ☐ texte intégral

11.

A quel secteur d'activité appartient votre société? (par ex. ingénierie, fabrication)

.....

12.

Votre société possède-t-elle une bibliothèque de normes?

- ☐ Oui
- ☐ Non

13.

En combien de volumes dans le cas affirmatif?

.....

14.

Quelle organisations de normalisation ont publiées les normes de cette bibliothèque (ISO, DIN, ANSI, BSI, etc.):

.....

15.

Ma société apporte sa contribution à l'élaboration des normes par les moyens suivants (plusieurs réponses possible):

- ☐ en achetant des normes
- ☐ en utilisant des normes
- ☐ en qualité de membre d'organisations de normalisation
- ☐ en qualité de membre de comités de normalisation
- ☐ autres .....

16.

Ma société utilise (une seule réponse)

- ☐ des normes en français seulement
- ☐ des normes en anglais seulement
- ☐ des normes bilingues anglais/français

17.

Autres observations

.....

.....

.....

.....

.....

18.

Pourriez-vous nous donner quelques informations sur vous-mêmes et votre société?

nom .....

fonction.....

nom de la société .....

addresse.....

.....

.....

.....

nombre d'employés.....

chiffre d'affaires:.....

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1162-1 (1995) Part 1: Single talker and multiple listeners.

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